THE REPUBLIC OF UGANDA
Ministry of Education and Sports

SECONDARY SCHOOL
ABRIDGED CURRICULUM
FOR UGANDA

- MATHEMATICS
- PHYSICS
- BIOLOGY
- CHEMISTRY
- AGRICULTURE

SENIOR 4

NCDC
NATIONAL CURRICULUM DEVELOPMENT CENTRE

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ABRIDGED CURRICULUM
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MATHEMATICS
PHYSICS
BIOLOGY
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SENIOR 4

A product of the National Curriculum Development Centre for the Ministry of Education and Sports with support from the Government of Uganda

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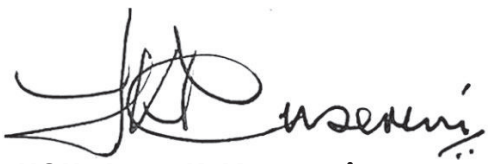
Foreword

The COVID-19 pandemic caused a disruption in our education system and made learners miss schooling for almost 18 months of the 2020-2021 schooling period. This has created a need to re-think what and how learners will learn when schools re-open.

The Ministry of Education and Sports through National Curriculum Development Centre (NCDC), has developed this abridged curriculum for Primary and Secondary schools in the country. This curriculum presents a selection of priority learning competences and concepts, along with psychosocial support, which should be the focus of instruction in the 2022 school year in order to achieve learning recovery.

This curriculum is not a departure from the existing curricula for the different classes but rather, a modification of the same with a purpose of recovering the lost learning time with minimum learning loss. It has been packaged for all Primary and Secondary classes with exception of Primary One, Senior One and Senior Five that will use the standard curriculum.

I therefore, recommend this abridged curriculum and ask all stakeholders to support its implementation as a strategic intervention towards the mitigation of the effects of COVID-19 pandemic on our education system. The effective implementation of this curriculum by the implementers will be a great milestone towards the recovery of lost learning time and giving hope and confidence to learners and teachers.



HON. Janet K. Museveni
First Lady and Minister for Education and Sports

Acknowledgement

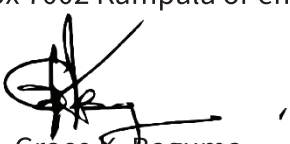
National Curriculum Development Centre (NCDC) would like to express its most sincere appreciation to all those who worked tirelessly towards the development of the abridged curriculum for Primary and Secondary levels of education.

The Centre is indebted to the NCDC Governing Council and the Academic Steering Board whose guidance and input helped to develop quality curriculum materials.

Great thanks go to the Specialists, panel members, the Quality Assurance and Editorial Committees that invested heavily in the conceptualisation, development and quality assurance processes that collectively delivered the materials that we have here. Their efforts, extra energy and professionalism has been unmatched.

This abridged curriculum was developed with support from The Government of the Republic of Uganda, Save the Children, UNESCO, Uganda National Examinations Board (UNEB), Directorate of Education Standards (DES), Universities, National Teachers Colleges (NTCs) and Primary Teachers Colleges (PTCs).

NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for addressing the gaps. Such comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email admin@ncdc.go.ug or www.ncdc.go.ug.



Dr. Grace K. Baguma
DIRECTOR,
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MATHEMATICS

Introduction

The content for senior three and senior four has been merged to come up with an abridged curriculum for senior three. The table below shows the guidance given to the teacher on which content has been deleted and which content has been merged.

SN	CRITICAL CHANGES	JUSTIFICATION
1	**Set theory** Following has been deleted • Define and use the compliment set • Use venn diagrams to represent sets and number of elements in a set • Apply practical situations using two and three sets	This content was taught in senior one. This content has been transferred to the topic of probability. The whole topic has been deleted.
2	**Algebraic expressions equations and inequalities** These learning outcomes have been de • Build the formulae from word problems • Work out involving inequalities symbols	Content was done in senior one
3	**Ratio and proportion** i)Defines ratios ii)Describes quantities in ratios iii)Change quantities in a given ratio iv)Defines proportion v)Tells the difference between direct and	These objectives are already done in senior two.

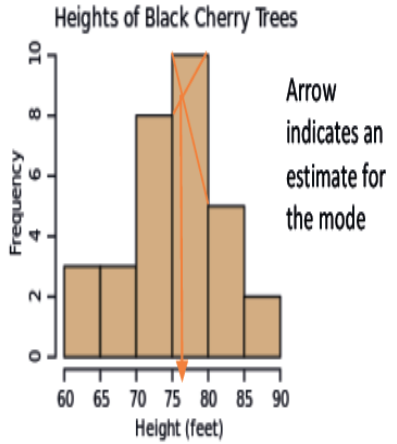
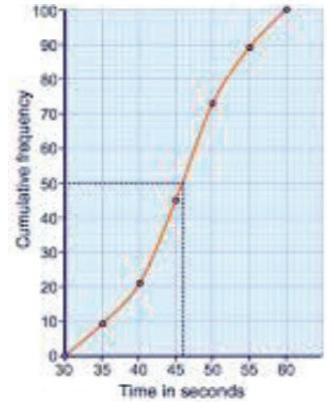
	inverse proportions vi)Interprets the given scales vii)Represents and interprets proportional parts viii) Works out solutions for direct and inverse proportions (omitted but still examinable)	
	Sine, Cosine and Tangent and Angles of elevation and depression These two topics have been merged together with Trigonometry	The content is linked
4	Further transformation This topic has been removed	Basic transformations have been covered in senior two
5	Locus This topic has been deleted	Loci has been done in senior one. The rest of the content will be learnt when learners get to senior five.

ABRIDGED CURRICULUM

SENIOR FOUR

Term I

TOPIC	COMPETENCIES The Learner should be able to;	KEY CONCEPTS	TEACHING/LEARNING ACTIVITIES	ASSESSMENT STRATEGY
STATISTICS (MODE, MEAN AND MEDIAN)	(i) Draw frequency tables for grouped data. (ii) Calculate mean using assumed mean (iii) Calculate mode and median. (iv) Draw a	• grouped data • Class limits • Class boundaries • Class size • Frequency distribution table for grouped data • Mean, mode, median of grouped	Explore the need for grouping data when there are many different values. Compare estimates from grouped data with the actual values from the raw data. Draw a histogram and estimate the mode	Draw a cumulative frequency graph and estimate the median The cumulative frequency diagram shows the time taken by 100 people to complete 10 press-ups. Find an estimate for the median time. Explain why only an estimate for the median is possible

	histogram and use it to estimate mode. (v) Form cumulative frequency distribution table. (vi) Construct an Ogive and use it to estimate the median.	data • Cumulative frequency • Histogram • Ogive		
PROBABILITYS	(i) Construct the probability space. (ii) Determine probability from experiment	•The difference between experimental and theoretical probability • Equally likely outcomes	Let the learners do the experiments and not just talk about them. Use simple everyday examples e.g. (dice, cards, match sticks, drawing pins)	• Observe the learners as they work on the tasks below. During the process, are learners communicating effectively? Are they learning from one another? Are they creative and critical? 1. Sara has the following

	and real life (iii) Tell the difference between theoretical and experimental probability. (iv) Identify mutually exclusive and independent events. (v) State theorems of probability (vi) Calculate the probability of compound events using Venn	• Possible outcomes of experiments • Possibility space in Cartesian • Probability using tree diagrams. • Probability from simple Venn diagrams and statistics	Learners should be encouraged to discuss events which are/are not equally likely outcomes in a given situation.	coins in her pocket bag: UGX 50; UGX 100; UGX 200; UGX 500; UGX 1000. She selects a coin at random to put into a charity collection box. What is the probability that she: a) gives more than UGX 200 b) has less than UGX 800 left in her bag c) has more than UGX 300 left in her bag d) gives at least 10% of the money in her bag e) gives more than one fifth of the money in her bag 2. A class has 30 girls and 40 boys. The probability that a boy selected at random is wearing stockings is 0.3. The probability that a girl

	diagrams.			selected at random is wearing stockings is 0.9. Calculate the probability that a learner selected at random from the whole class: a) is a boy b) is a girl wearing stockings c) is not wearing stockings 3.Ozo hosted a party with 300 guests. He served a meal with chicken (C) and meat (M). 200 guests had chicken. 130 guests had only chicken. 6 guests did not eat a meal. a) Represent this information in set notation b) Represent the information on a Venn

				diagram. c) How many guests ate both meat and chicken? d) How many guests had meat?
THE EQUATION OF A STRAIGHT LINE AND RATE OF CHANGE	i. State and use the gradients of a line to find the equation of the line ii. Determine the equation of a straight line using the x and y-intercepts iii. Apply the relationship of	•Gradient of a line. •Equation of a line. • Intercepts. • Variable rate of change.	Consider a ladder of length 10m. a) Place the foot of the ladder at i) 6m, ii) 5m, iii) 2m from the wall and lean the ladder against the wall b) What happens to the angle between the ground and the ladder as the foot of the ladder moves closer to the wall? c) Relate the steepness of the ladder with the distance between the wall and the foot of the ladder. Explain this relationship. • Introduce gradient as a measure of steepness/rate of change • Draw a straight line and a perpendicular line on a	Observe the learners in their groups as they carry out the tasks below. During the process, are learners communicating effectively? Are they learning from one another? Are they creative? 1. Asabi is going to plot the graphs of these six equations: y=2x+1, y=3x, y=x+4 2. y=+x=6, y=2x-5, 2y=3-x Without plotting the equations: Which graph will be steepest? Which will have the greatest y- intercept? Are any of the lines parallel or

	gradients of parallel and perpendicular lines to get the equation of a straight line iv.Determine the equation when a line is given on the graph. v). Tell the difference between rate of change and gradient. vi). Find the average rate		coordinate grid. What are their equations? Try for another pair. What do you notice about the gradients? • Investigate the least number of points that need to be plotted to draw a straight line.	perpendicular? Explain your answer. Sendi drew the graphs of 2x-3=y and y=7 on the same set of axes. What are the coordinates of intersection?

	of change vii).Determine the gradient of a curve at a point using a tangent			
SIMULTANEOUS EQUATIONS	i).Solve simultaneous equations using substitution and elimination ii).Draw graphs of simultaneous equations and find the solution iii).State the difference between linear	• Solving various problems simultaneously	Maureen buys 3 tins of peanut butter and 5 tins of margarine for UGX 32 000. Zulaika buys 6 tins of peanut butter and 8 tins of margarine for UGX 59 000. Musisi buys one tin of peanut butter and one tin of margarine. How much does he pay? How does the set of equations 3x+5y=32 and 6x+8y=59, relate to the problem above?	Observe the learners in their groups as they carry out the tasks below. During the process, are learners communicating effectively? Are they learning from one another? Are they creative? In groups, solve the following pairs of simultaneous equations using elimination method. (a) 7x + 3y = 32 3x + 12y = 78 (b) 6y + 14 = 7x

	equation and quadratic equation.			5x – 12 = 4y 2.Use substitution to solve the simultaneous equations: 3x + y = -2 4x + 2y = 0
MATRICES	i)Describe a matrix ii)State the order of a matrix iii)State types of matrices iv)Determine compatibility in addition and multiplication of matrices v)Find	• Rows and columns • Order of a matrix • Types of matrices • Operations on matrices • Determinant of a matrix • Inverse of a matrix • Singular matrix • Simultaneous equation	Through a class discussion guide the learners to discuss how items are arranged in a supermarket, books in a school library etc When can matrices be added together? $A=\begin{pmatrix}2&0&1\\3&0&0\\5&1&1\end{pmatrix}\quad B=\begin{pmatrix}1&0&1\\1&2&1\\1&1&0\end{pmatrix}$ $A+B=\begin{pmatrix}2+1&0+0&1+1\\3+1&0+2&0+1\\5+1&1+1&1+0\end{pmatrix}=\begin{pmatrix}3&0&2\\4&2&1\\6&2&1\end{pmatrix}$ When can matrices be multiplied	During the discussion, the learners will observe that the items are arranged in rows and columns Identify the order of the following matrices i)$(2\quad 1\quad 5)$ ii)$\begin{pmatrix}3\\7\\0\end{pmatrix}$ iii.$\begin{pmatrix}5&8\\-1&4\end{pmatrix}$ Use matrices to solve the simultaneous equations

	determinant of a 2 x 2 matrix vi)Find the inverse of a 2 x 2 matrix vii.Use matrices to solve simultaneous equations		together? $A = \begin{pmatrix} 2 & -1 & 0 \\ 3 & 0 & 1 \end{pmatrix}, B = \begin{pmatrix} 1 & 2 \\ 4 & 0 \\ -3 & 1 \end{pmatrix}$ $AB = \begin{pmatrix} 2-8+0 & 4+0+0 \\ 3+0-3 & 6+0+1 \end{pmatrix} = \begin{pmatrix} -6 & 4 \\ 0 & 7 \end{pmatrix}$ BA is not defined. Usually AB ≠ BA • The inverse matrix A^{-1} has the property that $AA^{-1} = A^{-1}A = I$ Find out how to derive the inverse matrix for 2×2 matrices. $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}, A^{-1} = \frac{1}{ad-bc}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$ determinant of A= $ad - bc$ • What happens if det A = 0? • Use matrices to solve pairs of linear equations in two unknowns. Explore what happens when there are no solutions.	(a) $3x + 5y = 25$ $2x + 4y = 18$ (b) $7m + 3n - 46 = 0$ $30 - 3m = 5n + 40$ Use the matrix method to show that the following pairs of simultaneous equations have no unique solutions. Why does this happen? (a) $6x - 9y = 36$ $2x - 3y = 5$ (b) $3x - 7y = 45$ $9x - 21y = 135$

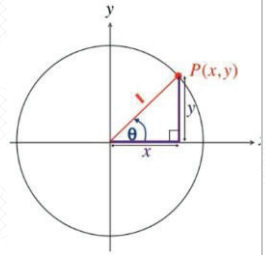
ALGEBRAIC – EXPRESSIONS, EQUATIONS AND INEQUALITIES	i) Re-write a given formula by changing the subject (i) Draw number line, and use it to find solutions of inequalities.	• Solving a problem. • Integral & fractional solutions.	Bayo, Ruth and John were all born on Independence Day, but in different years. Bayo is one year older than Ruth. John's age is 3 times Bayo's age. If Ruth is r years old, write down expressions for: (a) Bayo's age (b) John's age (c) How many years older than Bayo is John? Give your answer in terms of r (d) In 6 year's time, John will be 6 years older than Bayo. How old is Ruth now? a) Solve quadratic inequalities and represent the solutions on a number line.	Observe the learners in their groups as they discuss the tasks below. During the process of the presentation, are learners communicating effectively?, Are they learning from one another?, Are they creative and critical? In groups, workout the following: Alupo thinks of a number. She carries out two calculations on the number. First, she adds 5. Then she multiplies the sum by 3. Her result is 27. What was Alupo's original number?
QUADRATIC EQUATIONS	i).Solve quadratic equations	•Factorisation • Graphical	A rectangular garden with an area of 1000m^2. Its length is 30m greater than its width. Find the	Observe the learners in their groups as they work out the exercise below. Find

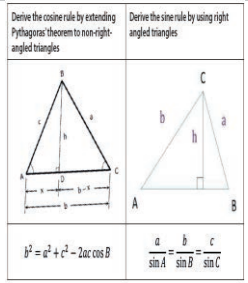
	using factorization, completing square and formula ii). Make tables of values from a quadratic equation using graphs iii).Solve quadratic equations using graphs iv).Form and solve quadratic equations from roots and given situations	method • Quadratic formulae	dimensions of the garden. Guide the learners to construct a table of values for a quadratic expression: $y = x^2$, $y = x^2 - 4, y = x^2 - 5x + 6$. Guide the learners to plot and draw the curves of the quadratic expressions. Use the graphs drawn to determine the solutions to the equations$x^2 = 0$, $x^2 - 4 = 0, 0 = x^2 - 5x + 6$ • Explore completing the square to solve quadratic equations and relate to graphs • Generalise completing the square to derivation of the quadratic formula for $ax^2 + bx + c = 0$ then $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$	out the learners' attitude towards the group work, integrity, are they doing the work in harmony? During the process of the presentation, are learners communicating effectively? Are they learning from one another? Are they creative and critical? In a group, workout the following: 1. A room p metres long and (p- 3) metres wide has an area of 40m^2. Obtain an equation in p. Find the value of p 2. Try to solve $x^2 - 3x + 4 = 0$ by: i) factors ii) completing the square

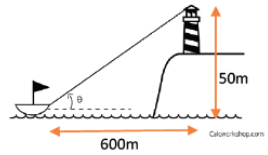
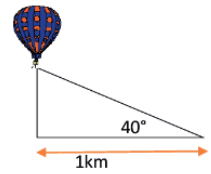
				iii) formula (a) For each method, state briefly the difficulty you encountered.
RATIO AND PROPORTION	i.State Joint and partial variations. ii.Apply joint and partial variations in solving problems iii.Using Compound proportion to solve real life problems	• Joint proportion • Partial variation • Compound proportion	The cost ,C,of running a grocery varies partly as a constant and varies as the number,n, of items sold. Guide the learners to find the relation between the cost C and the number, n, of items sold. information using ,,,,,,,,,missing link to complete the sentence.	•Observe the learners in their groups as they carry out the tasks below. During the process, are learners communicating effectively?, are they learning from one another?, are they creative and critical? •Mrs. Mukasa is a small-scale poultry farmer. It costs her UGX.250 000 to buy the feed to raise 70 broilers. • a)MrsMugisha wants to raise 300 broilers. How much will the feed needed to raise these broilers cost? •Day old broiler chicks cost

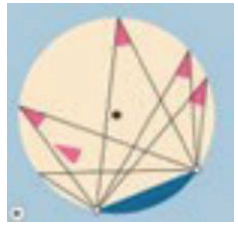
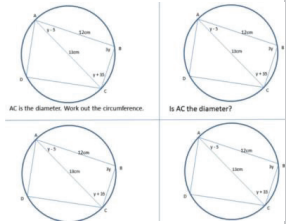
				UGX. 2000 each. MrsOpio has UGX. 1 000 000 (one million shillings). She wants to buy and raise as many chicks as she can. How many should she buy? In a Technology and Enterprise lesson, learners had a recipe to make small cakes. 8 cakes needed 400 grams of flour. a) Hadijah wants to make 20 of the cakes. How much flour does she need? b) Denis has 750 grams of flour. How many of the cakes can he make? Mrs. Mukasa is a small-scale poultry farmer. It costs her UGX. 250,000 to buy The feed to raise 70

				broilers.
COMPOSITE FUNCTIONS	i).Find the inverse of a function. ii) Find composite functions iii)Identify and find the value of the unknown when the statements are not clearly defined	• Input • Output • Operation on functions.	In pairs, consider the functions $f(x) = 6x$ and $g(x) = x + 5$ (a) What is f(3)? (b) What is g(f(3))? (c) What is g(3)? What is f(g(3))? Is g(f(3)) the same as f(g(3))? (d) What is f(f(5))=f^2 (5)? Repeat for x.	Observe the learners in their groups as they work on the tasks below. During the process, are learners communicating effectively? Are they learning from one another? Are they creative and critical? 1. f(x) is the greatest number prime less than x. Find: (a) f(40), (b) f(29) 2. If f(x) = 2x3 and g(x) = x – 1, find h(x)= f(g(x)) Find h(-1) (x), and sketch the graph of function h with its inverse. 3. Given f(x) = 2x and g(x) = x – 3, find; (a) f^3 (x) (b) $f(x^3)$ (c) g^2 (x) (d) $g(x^2)$ (e) gf(x) (f) f(g(x)) (g) f(g(f(x)))

Term II				
SINE, COSINE AND TANGENT	i)Define sine, cosine and tangent ratios from right angled triangles ii)Read /braille and use tables and calculators to find trigonometrical ratios iii.Use sine, cosine and tangent in calculating lengths of sides and angles of triangles. iv.Draw a unit circle to workout trigonometric ratios of angles greater than 90° v.Draw graphs of $y = \sin\theta, y =$	• The three trigonometrical ratios • Mathematical tables and calculator • Unit circle • Trigonometrical waves • Sine rule • Cosine rule • Angles of elevation and depression with reference to a horizontal plane	Practice on reading tables and the calculator to obtain the trigonometric ratios for different angles  Emphasize the use of four decimal places	• The hour and minute hands of a clock have lengths of 44mm and 57mm respectively. (a) Calculate the distance between the ends of the hands when the angle between the hands is 69°. (b) Calculate the angle between the hands when the ends of the hands are 32mm apart. • A pole 8.3

	cos θ for interval of 0° to 360° vi.Use the graphs to read sine and cosine rule for any triangle. vii.Apply sine and cosine rule in solving real life problems. viii) Apply the knowledge of trigonometric ratios to find angles of elevation and depression. (ix) Apply the knowledge of trigonometrical ratios to real life situations.		 State the difference between angles of depression and elevation.	metres long and a pole 11.5 metres long are placed on the ground with two ends in contact with each other. The distance between the other two ends is 4.7 metres. Find the angle between the two poles at the point of contact.

				1. Find the angle of elevation θ, of the top o the lighthouse.  2. Find the height above the ground of a hot air balloon, whose angle elevation from the ground 1km away, is 40° 
CIRCLE PROPERTIES	i. Identify arc, chord, sector and segment ii. relate angles made by an arc at the circumference and	• Angle at the centre • Angle in a semi - circle • Angles in the same segment • Cyclic quadrilateral • Alternate segment • Tangent properties	Find the centre of the circle. For a given chord measure the angle at the centre and the angle at the circumference of the major segment. What do you notice? Prove it.	Observe the learners in their groups as they work on the task below. During the process, are learners communicating effectively? are they learning from one another? are they

	centre iii. State the angle in the semi-circle iv. State the properties of a cyclic quadrilateral v. Find the length of the common chord Calculate area of sector and segment	• Chord properties	Repeat for the minor segment.  Guide the learners to state (i) the properties of cyclic quadrilaterals. (ii) the properties of tangents to a circle. (iii) the properties of the chord	creative and critical? Solve the problems below 
MATRICES OF TRANSFORMATIONS	finding the image given the object and the matrix of	• Using matrices to find the image of the given object. • base /unit vectors of	Find the matrix corresponding to the transformation by considering the	1. O (0, 0), A (3, 0), B(3, 3) and C(0, 3) are the

	transformation i. Identify the matrix of transformation when the object and its image are given. ii. (iv) using the I(1,0) and J(0,1) to determine the basic matrices of transformation iii. (v) find the single matrix of transformation representing the successive transformatio	points I(1,0) and J(0,1) • successive Transformations: • Inverse transformation	images of the point I(1, 0), J(0, 1) and K(1, 1): (a) reflection in the line x + y = 0 (b) a 90degrees anti-clockwise rotation about the origin (c) an enlargement, centre the origin, scale factor k. What do you notice about the determinant of the transformation matrix? Plot the following five triangles on grid paper. T1 (1, 1), (5, 1), (5,	vertices of a square OABC. A/ (4, 2), B/(6, 6) and C/(2, 4) are the vertices of OA/B/C/, the image of OABC such that the origin is invariant. Find: (a) the transformation matrix (b) the area of OA/B/C/. 2. Describe the transformations defined by the matrices $\boldsymbol{A} = \begin{pmatrix} \frac{1}{2} & -\frac{\sqrt{3}}{2} \\ \frac{\sqrt{3}}{2} & \frac{1}{2} \end{pmatrix}$ $\boldsymbol{B} = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$

	ns iv. (v) Determine the inverse of a transformation matrix v. (vi) Use the inverse matrix to find the object when the image is given. vi. (vii) Identify the relationship between area scale factor and determinant of the transformation matrix.		3), T2 (1, 1), (1, 5), (-1, 5) T3 (-1, 1), (-5, 1), (-5, 3) T4 (-1, -1), (-5, -1), (-5, -3) and T5 (1, -3), (1, -5), (5, -3) Describe a single transformation that maps: (a) T3 onto T1. (b) T4 onto T5 (c) T1 onto T2 (d) T4 onto T3 (e) T1 onto T4 (f) T4 onto T2, and determine the transformation matrix. Determine the	Evaluate AB and BA. Describe the transformation each represents. A shape P is subject to transformation AB to give image PAB. The same shape P is subject to transformation BA to give image PBA. Describe the single transformation that will map PAB to PBA.

			transformation matrix to 'undo' each transformation. What do you notice? Investigate combining transformations and the corresponding transformation matrices.	
BUSINESS MATHEMATICS	i. Apply the compound interest formula for calculating interest ii. Calculate hire purchase iii.Calculate income tax given	• Hire purchase • Compound interest • Appreciation and depreciation • Taxation. • Mortgage.	Explain the meaning of the following terms, hire purchase, compound interest, mortgage, taxation , appreciation and depreciation Which is the best	Ashok invests UGX 100 000 in a savings account that pays 10% compound interest each year. Assuming no further money is invested and no withdrawals are made, how many years does it take to

	income tax bands.		savings account: 1% compound interest paid monthly, 3% compound interest paid every three months, 6% compound interest paid every six months, 12% paid annually? • Consider which assets appreciate, and which depreciate.	double his money?
GEOMETRY/MENSURATION	i) Identify and sketch common solids ii)Identify prism iii)Form nets and solids iv)Calculate	• Areas and Volumes of Solids develop the skills of determining the Magnitude of various Solids in terms of Area and Capacities • Properties of two dimensional figures.	Cut a triangle from a piece of scrap paper – fold to show how the area of a triangle is related to the area of a rectangle In groups,	Observe the learners in their groups as they carry the tasks below. During the process, are learners communicating effectively? Are they learning from one

	surface areas of three-dimensional figures v)Calculate the volume of some figures (e.g. cubes and pyramid)	• Relate two dimensions to three dimensions • Use nets to differentiate between two dimension or three-dimensional figures • Use nets to find area of three-dimensional figures.	learners construct cubes, cones, cuboids and pyramids using local materials and measure their dimensions	another? Are they creative and critical? A square storeroom has sides of length 2 metres and a door near one corner. What is the length of the longest pole that can be stored safely, resting on the floor of the room? Task learners to calculate the volumes of the figures that they have constructed and then express them in different units. Observe how they co-operate
LINES AND PLANES IN THREE DIMENSIONS	i).Apply Pythagoras theorem to	• Pythagoras theorem • Estimation of angles between lines and	Construct a square-based pyramid using four	Observe the learners in their groups as they

	calculate the distance between two points (ii) Identify a common point (iii)Find the angle between a line and a plane (iv)Find the angle between two planes.	planes. • Angles between planes.	equilateral triangles and a square. Use Pythagoras' theorem to determine the perpendicular height of the pyramid, check by measuring your model.	discuss the task below. During the process of, are learners communicating effectively? Are they learning from one another? Are they creative and critical? A wireless mast is held vertically by four stays 10m long, fixed to the mast at the same height and joined to the four corners of a square on level ground. If each stay is inclined at 600 to the horizontal. Calculate the height of the top of each stay and the side length of the square

Term III				
LINEAR PROGRAMMING	(i).Form linear inequalities based on real life situations. (ii) Represent the inequalities on the graph (iii).Show the required region of the inequalities. (iv).Solve and interpret the optimum solutions of the linear inequalities	• Planning/ Programming. • Solving problems.	In groups, discuss how to form the inequalities that must be satisfied. Plot them on a coordinate grid and propose a solution. Peter has UGX 900 000. He wants to buy some apples and oranges. Apples cost UGX 10 000 each and oranges cost UGX 600 each. He wants to buy at least 22 apples and at least 10 oranges. The number of apples bought must be more than twice the number of oranges bought. Use linear programming to solve this problem.	In pairs, let the learners discuss the following task. Observe them as they discuss. Assess the learners on the core values and generic skills. 1. A mother buys x notebooks at UGX 600 each and y pens for UGX 800 each. She has UGX 8000 to spend and there must be at least 4 notebooks and at least 4 pens. Write three inequalities in x and y that satisfy these conditions. Illustrate them graphically by shading out the unwanted regions. Write down the

				integer solution set. 2. A farmer has 32 acres on which to plant corn and soybean. For each acre of corn planted, the expenses are UGX 100 000, and for each acre of soybean planted it is UGX 200 000. Each acre of corn requires 100 bushels of storage and yields a profit of UGX 120 000. Each acre of soybean requires 40 bushels of storage and yields a profit of UGX 180 000. If the total amount of storage space is 1920 bushels and the farmer has only UGX 8M to pay for planting, how many acres of each crop should be planted to maximize

				the profit? What will the profit be?
VECTORS	i. Use vector method in dividing a line proportionately internally ii. Use vectors using lower case letters to determine displacement vectors iii. Use vectors to show parallelism Use vectors to show collinearity	• Vectors develop the skills of decision making in terms of Magnitude and direction of the various movements • collinearity	Recall and review the difference between a vector and scalar quantity Give examples. Identify parallel and equal vectors. Use vector addition and subtraction	• Use vectors to find the midpoint of the line segment AB where A is (1, 7) and B is (-3, -3). • The point (1, 1) divides the line segment AB internally in the ratio 3:4. A is (-2, 7). Use vector methods to find the coordinates of B. Use vectors to establish whether the points (5, 2), (-3, 6) and (9, 4) are collinear.

PHYSICS

ABRIDGED PHYSICS CURRICULUM FOR SENIOR FOUR

Introduction

The abridged Physics Syllabus for Senior Four has been designed to address the learning gaps that were created as a result of the Covid 19 pandemic. It is hoped that you were able to cover some aspects of Mechanics and General Physics, Light, Heat and Waves in the previous classes before lockdown. Critical content has been sorted and put together to be taught in a period of one year. The syllabus combines work which was not taught in Senior Three before the lock down and that for Senior Four, in a condensed way. In order to avoid repetition of related concepts, learning has been structured around the major thematic areas i.e Electricity and Magnetism and then Modern Physics. It is hoped that the content areas included in this syllabus will enable the learner to acquire the target knowledge, understanding, skills and values for the progression in Physics, in addition to what was covered in the previous classes.

The critical changes are highlighted in the matrix below.

SN	CRITICAL CHANGES	JUSTIFICATION
1	Electrostatics, which was supposed to be covered in S.3 has been left out.	It is also taught at A-level, so cannot hinder the learners progress. It has no relation with other topics
2	Heat quantity, latent heat and vapors which were supposed to be studied in S.3. were not carried to S.4.	The same content in these topics is repeated at A-level and leaving them out will not affect the progress of the learners in any way
3	Expansion of solids and liquids; bending beams and effect on	Learners to meet these in chemistry lessons. They are also

	shapes, and properties of materials under stress which were supposed to be carried forward from S.3. to S.4 were left out.	taught in A-level
4	Atomic and nuclear structures, and radioactivity were combined to form nuclear processes	The content is related

Term I

TOPIC 1: Electric cells

Topic/ subtopic	Objectives *Learners should be able to:*	Key concepts	Teaching/learning activities	Assessment strategy
• Sources of e.m.f • The simple cell • Primary and secondary cells • Alkaline cells	- a. Demonstrate understanding that cells convert other forms of energy into electrical energy, producing current - b. Demonstrate understanding that electric cells are very useful but have their limitations a. explain the concept of	Electric cells convert other forms of energy into electric energy for various applications	i. In groups, learners design a simple cell and explain how it produces electricity ii. In pairs, learners brainstorm, research and discuss: • Common practical applications of electric cells • Applications for which cells are not appropriate and why iii. Use a car battery to	• Listen to group and pair discussions and check understanding by asking probing questions • Observe pairs engaged in practical activities and intervene to ensure investigations lead to expected gains in understanding.

	primary and secondary cells b. Describe the process of charging an accumulator		study structure operation, care and charging of accumulators.	

Topic 2: Introduction to current electricity; voltage, resistance and Ohm's law

• insulators and conductors • electric current and its measurement • circuit symbols • series and parallel circuits • Ohm's law.	ı. explain the nature of electric current, its sources, what makes it flow around circuits and how it is measured ›. identify electrical conductors and insulators using experiments :.recognise, understand and apply knowledge of series and parallel circuits l. identify symbols to represent components in a circuit :.explain the concept of electrical	• Current is the flow of charges in conductors. This has several applications • Resistance has an effect on the current through a material and the voltage across it.	i. In pairs, learners research and use diagrams to explain the symbols used in a circuit diagram and the differences between series and parallel circuit i. In groups, learners investigate and report the relationship between voltage and the brightness of bulbs i. In groups, learners investigate the electrical conductivity of different materials v. Learners investigate	. Assess how learners interpret series and parallel circuits in different situations . Evaluate how learners relate current, voltage and resistance in different numerical problems.

	resistance . explain how resistance is measured, its relationship to current and voltage, and the factors that affect it . state and verify Ohm's law.		and explain the current flowing through different parts of series and parallel circuits, and explain why domestic circuits are in parallel. v. learners plan and report on practical investigations to: • Find the resistance of bulbs, heating coils, electric motors, dry cells • measure current and voltage and apply Ohm's Law to calculate resistance • use Ohm's Law to predict	

			current, voltage or resistance, before checking predictions with actual measurements • find the effective resistance when a number of resistors are connected in series and in parallel.	

Term II

Topic 3: Magnetic effect of current and Electromagnetic induction

• Magnetic fields • Magnetic effect of electric current • Applications of electromagnets	• Investigate the behaviour of magnets and magnetic fields • Understand that a current-carrying conductor produces a magnetic field	The presence of a magnetic field produces a current and vice-versa. This has many applications.	• In groups, learners review prior knowledge about the characteristics of magnets, the magnetic fields around a bar magnet and make reports	• Listen to group and pair discussions about magnetism and pose questions to promote critical

• Electromagnetic induction • A.C. and D.C. generators • The transformer.	that can be detected Describe and explain the application of electromagnets in a variety of devices Describe the magnetic effect of a current and electromagnetic induction Explain the difference between a.c. and d.c. generators Explain how a.c. and d.c. can be interconverted Explain the mode of operation of transformers.		• In pairs, learners research how to make an electromagnet and investigate the factors affecting the strength of the electromagnet • In groups, learners, discuss the application of electromagnets in an electric bell, a d.c. motor, a relay, a telephone receiver and a loudspeaker • In pairs, learners investigate the process of electromagnetic induction and how it is applied in a.c. and d.c. generators • In pairs, learners research how a.c. and d.c. can be interconverted and classify domestic	thinking • Assess how learners construct and describe how electromagnetic devices operate • Assess learning through the quality of products: investigation reports, diagrams, presentations and posters, providing guidance to correct misconceptions • Assess how learners solve numerical problems

			appliances according to whether they operate on a.c. or d.c. and explain how transformers operate.	related to transformers.

Topic 4: Distribution and consumption of electric energy

• Distribution of electric energy • Energy transformation in electric devices • Mains electricity and safety • Costing of electric power	a. describe the distribution of electricity from the source to consumer units b. describe energy transformation in common domestic electrical devices c. explain how to use mains electricity safely d. understand how to read a domestic electricity meter e. appreciate the importance of the use of energy-saving appliances.	Electricity is generated and distributed through cables in long distances up to consumer units and this has some economic implications.	• In pairs, learners research how electricity is transmitted from the power station to the consumer and explain the advantages of using a.c. in commercial electricity supplies • In pairs, learners research and report on the power ratings of domestic electrical appliances, and use them in calculations of the cost of running these devices for a known period.	• Assess learners in discussions involving transmission of electricity and its consumption and offer support where necessary • Assess learners on how they calculate the cost of running different electric devices.

Term III

Topic 5: Structure of atoms and emission of electrons from matter

• Atomic structure • Cathode rays • Thermionic emission • The CRO (cathode ray oscilloscope) • X-rays.	a. state/sign the components of atoms b. explain the terms: atomic number, mass number and isotopes, and use them to represent different nuclides c. describe processes by which electrons are ejected from atoms d. explain the production, nature and applications of cathode rays and X-rays e. Investigate the properties and uses of cathode rays. f. Draw the CRO and explain how it works g. Draw wave forms produced on a CRO.	Atoms are the smallest building blocks of matter. However, they are made up of smaller particles. Thermionic emission leads to production of useful particles and radiation.	• In pairs, learners research the Rutherford model of the atom, explaining atomic structure and components of a range of elements and isotopes • In groups, learners research and explain production, behaviour and applications of cathode rays and X-rays.	• Listen to/ observe group and pair discussions and pose questions to check knowledge and understanding • Assess learners on the representation of different nuclides.

Topic 6: Nuclear processes

• Radioactivity • Half-life • Nuclear fusion and fission	a. Demonstrate understanding of the processes of nuclear fission and fusion and the associated energy changes b. Show understanding of the spontaneous and random nature of nuclear decay and interpret decay data in terms of half-life c. Prove knowledge of the applications of radioactivity and the dangers associated	1. Some elements become stable by emitting particles and rays that have numerous applications. 2. Joining or breaking of nuclei involves the release of energy that can be put to various uses.	1. In groups, learners research and use knowledge of atomic structure to explain: › the processes of nuclear fission and › nuclear fusion › how energy is produced in a › controlled way in a reactor › how nuclear energy is used 2. In groups, learners research on the decay of radioactive isotopes, half-life, background radiation and its origin, penetrating powers of different types	•Listen to/ observe group and pair discussions and activities, asking probing questions to promote critical thinking and deeper learning • Assess the quality of presentations to evaluate and accelerate progress towards the learning outcomes.

	with exposure to radioactive materials. d. Understand and appreciate that there are significant social, political and environmental aspects of radioactivity.		of radiation, why waste containing radioactive isotopes with long half-lives presents a serious environmental problem, medical and industrial uses of nuclear materials. 3. Learners research the advantages and disadvantages of nuclear materials with reference to world events, and the regulations about the use and control of radioactive materials.	

BIOLOGY

SENIOR FOUR BIOLOGY – ABRIDGED CURRICULUM

Introduction

The Senior Four abridged syllabus has been designed to address the learning gaps that were created as a result of the covid-19 pandemic. The syllabus is a combination of content from the 2008 O'level biology curriculum for Senior Three and Senior Four. The critical content has been sorted and put together to be taught in a period of one year. The abridged syllabus contains key concepts in all topics from both classes. In order to compensate for the lost time, concepts that were taught at lower levels (for example excretion in lower organisms, structure of a seed etc.) are left out. learning outcomes with similar content are merged or transferred to another class. Content that was not relevant to the abridged curriculum is also left out (for example systems and processes other than those in mammals). It is assumed that "Gaseous Exchange" was covered during the time before the lockdown. It is hoped that the content areas included in this syllabus will enable the learner to acquire the target knowledge, understanding, skills and values for their progression. The teacher's and learners are encouraged to make reference to the Biology home study materials that can be accessed on the center's website www.ncdc.go.ug.

The matrix below shows the key changes that were made in abridging the Senior Four syllabus and their justification.

KEY CHANGES	JUSTIFICATION
All S.3 topics moved to S.4 except gaseous exchange and all S.4 topics are maintained.	These topics had not been covered before students went for lock down except gaseous exchange.
Respiration.	Concepts are not key in the abridged

Objectives on site, product and some experiments of respiration are left out.	curriculum.
Excretion. Excretion in lower organisms was left out. Mammalian skin was left out.	Concepts are not key in the abridged curriculum. Major concepts covered at primary level.
Co-ordination in plants and animals. Objectives on; -experiments on plant hormones and responses are left out. - differences between enzymes and hormones are left out. -peripheral nervous system and synapse are left out Ear, nose and tongue are left out.	Concepts are not key in the abridged curriculum. Learners are able to generate their own comparison after understanding. Concepts are not key in the abridged curriculum.
Locomotion Objectives on divisions of vertebrae and limbs of the skeleton are left out Sub-topic on locomotion in	Concepts are not key in the abridged curriculum.

insects fish and birds is left out.	
Growth and development Objectives on: mitosis, internal structure of a seed, seed germination, meristems, growth patterns in insects, amphibians and mammals, complexity and form on plants and animals are left out. Objectives on comparisons between endospermic and non-endospermic seeds, epigeal and hypogeal germination, stages of development in insects, experiments on the growth of a frog are left out.	Concepts are not key in the abridged curriculum. Major concepts covered at primary level.
Reproduction in plants and animals Objectives on asexual reproduction in lower organism are left out. Objectives on sexual reproduction in lower	Concepts are not key in the abridged curriculum. Concepts are covered at lower levels.

organisms, bony fish, amphibians and birds are left out. Objectives on structure of a flower and pollination are left out	
Genetics and evolution Objectives on how artificial selection is achieved are left out Objectives on types of mutations are left out. Objective on evidences of evolutions are left out.	Concepts are not key in the abridged curriculum.
Interrelationships Objectives on methods of sampling are left out. Objectives on schistosomiasis, malaria and trypanosomiasis are left out.	Concepts are not key in the abridged curriculum. Concepts are already known by the learners.

Detailed Syllabus

SUB-TOPIC	SPECIFIC OBJECTIVE	CONTENT	TEACHING AND LEARNING STRATEGIES
Topic: Respiration			
Aerobic Respiration (03 periods)	• State the substrate and products of chemical oxidation of food in a cell. • Show the process of respiration in an equation form. • Define aerobic respiration. • State the site and importance of aerobic respiration in living organisms. • Demonstrate heat	• Chemical oxidation in the cell. • Practical activities – heat generation during respiration, analysis of breathed in and exhaled air.	• Discussion on aerobic respiration. • Guided discussion on site and products of aerobic respiration. • Experimentation on heat generation and nature of inhaled and exhaled air.

	generation during aerobic respiration.		
Anaerobic Respiration (04 periods)	• Define anaerobic respiration • State the importance of anaerobic respiration. • Demonstrate fermentation in yeast.	• Definition of anaerobic respiration. • Practical on anaerobic respiration	• Discuss anaerobic respiration, where it takes place and its importance. • Practical on fermentation in yeast.
Topic: Excretion and Homeostasis			
Excretion in Plants (01 period)	• Name plant waste products. • Explain the role of stomata in getting rid of water vapour and carbon dioxide. • Explain how plants get rid of other	• Plant waste products: Carbon dioxide (CO2), Oxygen (O2), water, resins, tannins, latex • Special methods of getting rid of waste products by plants. • Useful plant waste products	• Discussion on excretion in plants; waste products and forms in which they are eliminated. • Guided discussion on useful plant waste products

	waste products. • Explain how some waste products of plants are useful to humans.		
Excretion in Animals (07 periods)	• Draw and label the parts of the urinary system. • Describe the structure of mammalian kidneys. • Explain how kidneys function in getting rid of waste products from the body. • Describe how the lungs get rid of excess heat,	• Urinary system. • Structure and function of a mammalian kidney. • Role of the kidney in osmoregulation • Lungs and their role in temperature regulation and excretion of water and carbon dioxide. • Role of the liver in formation and elimination of urea. • Role of the liver in maintaining internal environment. • Practical – test for glucose and albumen and	• Demonstration on position / location of kidneys in a mammal. • Discuss role of kidneys in osmoregulation. • Guided discussion on excretory wastes by the lungs, and their elimination from the body. • Practical approach • Discussion on formation of urea and its elimination. • Guided discussion on the importance of

	water and carbon dioxide from the body. • Explain how urea is formed in the liver and eliminated . • Define homeostasis. • Explain the role of the kidney in osmoregulation. • Explain how the liver regulates blood sugar level in the human body. • List other functions of the liver. • Conduct an experimen	dissection of a mammal to show position of kidneys (by teacher).	maintaining internal environment • Practical: test for components of urine e.g. glucose and albumen

	t to find out presence of sugar and albumen in urine sample.		
Topic: Co-ordination in Plants and Animals			
Reception and Response in Plants (03 periods)	• Explain the term irritability, stimulus and response. • Name the different types of stimuli and the corresponding receptor organs. • Explain what a nastic response is and its importance in organisms.	• Definition of irritability, stimulus and response. • Nastic response. • Tropic responses. • Chemical control of responses in plants. • ~~Experiments on nastic and tropic responses.~~ • Use of other plant hormones e.g. Gibberellins. • Comparison of auxins and gibberellins.	• Discussion on different types of stimuli and responses. • Guided discussion on the importance of irritability. • ~~Field work to study nastic responses.~~ • Guided discussion on gibberellins.

	• Define a tropism. • List the types of tropisms. • Explain phototropism, geotropism and hydrotropism using real life examples. • Explain what auxins are and their role in plant growth. • Conduct an experiment on effect of auxins on plant growth. • Give the uses of other plant hormones such as gibberellins.		

Reception, response and behavior in animals (02 periods)	• Define a tactic response. • List the types of tactic responses using suitable examples. • Explain the importance of tactic responses to the organism. • Demonstrate tactic responses using on earthworm or fly larvae/maggot / wood louse.	• Tactic response in animals. • Types of tactic responses (photo, chemo, moisture, temperature, touch). • Importance of tactic responses. • Practical activity.	• Discussion on nature of tactic responses and their importance. • Experiment on tactic responses.
Chemical Coordination in vertebrates (02	• Define a hormone. • List the names and locations of endocrine glands. • Name the	• Definition of a hormone. • Endocrine glands – names, location and functions. • Hormones produced by endocrine glands • Role of pituitary gland.	• Discussion on endocrine glands their location, the hormones they secrete and the different functions of the hormones.

periods)	hormones produced by the endocrine glands. • Explain the effects of the various hormones in the human body. • Explain how the pituitary gland controls the other endocrine glands.	• Comparison of hormones and enzymes	• Guided discussion on role of pituitary gland.
Nervous coordination in a mammal (06 periods)	• Define a neurone. • Define the term stimulus, effector and receptor. • Describe the structure and function of a nerve cell. • Describe	• Nerve Cell (neurone) structure, function and types. • Structure and function of nerve. • Parts of nervous system (central and peripheral nervous system). • Types of reflex actions (simple and conditioned reflexes).	• Discussion on nerve cells, receptors and effectors. • Discussion on parts of the nervous system and their functions.

	the different types of nerve cells. • Describe the direction of the nerve impulse from receptor to effector. • Describe the parts/divisions of the nervous system and the organs associated with each division. • Describe the structure and general functions of the brain and spinal	• Reflex arc. • Practical activity – knee jerk, blinking of eye, and Pavlov experiment.	

	cord. • Describe the path of a reflex arc. • Explain the difference between simple and condition ed reflexes. • Demonstr ate a knee jerk, blinking of eye as examples of reflex actions. • Describe Pavlov's experime nt on condition ed reflex.		
Receptor organs in mammals (06 periods)	• List the physical and chemical stimuli. • List the various receptor organs.	• Types of stimuli (physical and chemical). • Receptor organs in a mammal • Structure and function of the	• Guided discussion on physical and chemical stimuli, and receptor organs in a mammalian body

	• Name the various parts of the human eye. • Explain the function of each part of the human eye. • Explain how the eye views near and far objects. • Name the eye defects and their causes. • Explain how the eye defects can be corrected. • List the various parts of the human ear. • Explain the function	mammalian eye. • Accommodation of the eye, eye defects and their corrections. • Structure and function of a mammalian ear. • Causes of deafness • Structure and functions of the skin. • Role of skin in regulation of body temperature and sensing of pressure.	• Discussion on structure and function of the mammalian eye, accommodation, eye defects and correction • Discussion on structure and function of the ear. • Discuss structure and function of the skin in relation to sensitivity.

	each part of the human ear. • Explain causes of deafness. • Name various parts of human skin and their function. • Explain the role of the skin in regulating body temperature and sensing of pressure.		
Topic: Locomotion in Animals			
Locomotion in a mammal (15 periods)	• Define locomotion. • State the types of skeletons and their function. • List the	• Definition of locomotion • Need for locomotion • Types of skeletons. • Definition of a joint • Types of joints	• Discussion on the need for locomotion in animals. • Guided discussion on types of skeletons and

	functions of the mammalian skeleton. • Define a joint. • Describe the structure of a joint. • Describe the different types of joints. • Explain the functions of the joints. • Explain what antagonistic muscles are. • Explain the functioning of antagonistic muscles.	and their functions • Antagonistic muscles and their function	their functions. • Demonstration of the various types of skeletons. • Discussion on types of joints, their location and functions.

Topic: Growth and Development in Plants and Animals

Growth in plants and animals (06 periods)	• Define the terms *growth* and *development*. • Draw and label the internal and external parts of a seed. • Explain seed dormancy. • List the factors / conditions necessary for seed germination. • Conduct experiments on for conditions necessary for seed germination	• Definition of growth and cell division. • Seed structure • Conditions necessary for germination. • Seed dormancy, causes and how to break it. • ~~Regions of elongation in roots and stems.~~	• Discussion on growth and role of mitosis. • Practical on germination. • Explanation on seed dormancy and its causes. • Explanation on cell division and enlargement

	• List causes of seed dormancy . • Explain how seed dormancy can be broken. • State the importanc e of seed dormancy . • Explain how growth is brought about by cell division and cell enlargem ent in organisms • Conduct experime nt on plant growth over time and plot a growth-ti me graph on the growth		

	observed.		
Development in plants and animals (05 periods)	• Explain the process of secondary growth of stems in dicot-plants. • Define the term metamorphosis. • Explain the difference between complete and incomplete metamorphosis. • Describe the stages of development in an amphibian and a mammal. • Record observations on	• Secondary growth of stem in dicot plants and dicot seeds. • ~~Germination in a monocot~~ • Metamorphosis in insects (cockroach and butterfly). • Stages of development in amphibians and mammals. • Measurement of weight of human baby for a given period of time. • Practical activities: Growth in a baby Use of	• Discussion on secondary • growth and how it is brought about ~~Observe and record stages of~~ • ~~germination in dicot and monocot seeds.~~ • Projects on stages of insects growth and development.

	growth of human baby by weight for a period of 4 months using a health card.	health card.	
Topic: Reproduction in Plants and Animals			
Asexual Reproduction in lower organisms (01 periods)	• Define asexual reproduction.	• Asexual reproduction.	• Discussion on asexual reproduction in lower organisms.
Asexual Reproduction in plants (vegetative reproduction) (04	• Define vegetative reproduction • List plant structures used in vegetative reproduction. • Explain vegetative	• Concept of vegetative reproduction in plants • Stem tubers and bulbs • Suckers and rhizomes and their parts. • Corms and its parts.	• Discuss vegetative reproduction in plants. • Guided discussion and explanation on stem tubes, bulbs, suckers, rhizomes

periods)	reproduction using leaves of Bryophyllum. • Draw and label vegetative reproductive organs. • Explain how stem cuttings are used to produce new plants. • Describe the procedures used in budding, marcoting, layering and grafting to produce new plants. • Explain the importance of artificial propagati	• Practical activity on drawing and labelling of vegetative parts.	and corms. • Brainstorm on advantages and disadvantages of vegetative reproduction

	on with regard to crop productio n.		
Sexual Reproduct ion in lower organisms (01 period)	• Define sexual reproduct ion.	• Definition of sexual reproductio n.	• Discussion on sexual reproduction in lower organisms
Sexual reproducti on in animals. (05 periods)	• Draw and label male reproduct ive parts in humans. • Draw and label female reproduct ive parts • Describe the menstruat ion cycle. • Describe the process of fertilizatio n of an ovum and	• Sexual reproduction in a mammal: Male reproductive organs. Female reproductive organs. Menstruation cycle. • Fertilization and development of embryo in humans. • Role of the placenta during	• Illustration on male and female reproductive parts and explanation on their functions. • Guided discussion on menstrual cycle and secondary sexual characteristics. • Discussion and explanation on

	the developments up to birth. • State the role of the placenta during pregnancy. • Describe birth and parental care of the young. • List birth control methods • Describe the use of each birth control method, its side effects and effectiveness. • State what STDs are. • State the cause of HIV/AIDS. • Explain the mode of transmission of STDs	pregnancy. • Birth of the young and parental care. • Method of birth control. • What STDs, STIs, HIV/AIDS are • Causes and mode of transmission. • Signs and symptoms of each STDs. • Prevention of STDs and HIV/AIDS.	fertilization and development of embryo in humans. • Brain storm on methods of birth control. • Discuss the different types of STDs, causes, prevention and control. • Observations on stages of an insect in laboratory.

	and STIs. • Describe signs and symptoms of each STD. • List preventive measures for each disease (STD).		
Sexual Reproduction in Plants (05 periods)	• Describe the process of fertilization. • Explain the formation of fruit and seeds. • Explain how a fruit differs from a seed. • Explain the economic importance of flowers. • Explain fruit and seed dispersal. • Describe methods of fruit and seed dispersal • List the	• Fertilization and formation of fruit and seeds. • Differences between fruits and seeds • Definition of fruit and seed dispersal • Methods of fruit and seed dispersal. • Importance of fruit and seed dispersal. • Agents of fruit and seed dispersal.	• Explanation on formation of fruits and seeds. • Discussion on the fruit and seed • dispersal, agents involved and its importance. • Brainstorm on the adaptations of fruit and seed for dispersal • Practical on drawing of fruits and seeds to show the adaptations they have for

	agents of fruit and seed dispersal. • State the adaptations of fruits and seeds that aids their dispersal. • Explain the importance of fruit and seed dispersal. • Draw and label fruits and seeds showing their adaptations for dispersal.	• Adaptations of fruit and seeds for dispersal by various agents. • Practical activity on flowers, fruits and seeds.	dispersal.
Topic 11: Genetics and Evolution			
Mitosis and meiosis and their importance (04	• Describe the process of mitosis • Describe the process of meiosis. • Explain the significance of both types of cell	• Mitosis and meiosis • Comparison of mitosis and meiosis. • Significance of mitosis and meiosis.	• Discussion on differences between mitosis and meiosis. • Brain storm on the importance of each type of cell division

periods)	division.		

Genetics and Monohybrid Inheritance (04 periods)	• Define genetics.
	• Explain Mendel's Monohybrid ratio.
	• Work out Mendel's Monohybrid ratio.
	• Explain the mechanism of heredity.
	• Explain the terms dominance, recessive, homozygous, heterozygous, phenotype and genotype, hybrid, test cross.
	• Construct a punnet square (crosses) to explain genotypes of offsprings.
	• Explain co-dominanc
		• Definition of genetics.
		• Mendel's Monohybrid ratio
		• Heredity through Mendel's law of Independent segregation.
		• Definitions of dominance, recessive, homozygous, heterozygous, phenotype, genotype and their respective ratios.
		• Incomplete dominance or co-dominance and its cause
		  • Co-dominance in blood groups, sickle cell trait.
		  • Role of principles of heredity in plant and
			• Discussion and explanation on genetics and Mendel's work.
			• Demonstration on how to arrive at monohybrid ratio.
			• Explanation of the genetic terms.
			• Discussion on dominance and co-dominance
			• Field trips to Agricultural Colleges / Institutions.
			• Discuss the advantages of hybridization.

	e. • Explain co-dominance in blood groups, sickle cell anaemia. • Explain the role of heredity in producing the desired varieties of plants and animals. • Explain the advantage of hybridization (cross breeding).	animal breeding. • Hybridization and its importance.	
Sex determination and hereditary diseases (06 periods)	• List the differences between autosomes and sex chromosomes. • Explain the terms chromosome, gene and DNA. • Compare the chromosome number of a body cell, a	• Chromosome, • Genes and DNA. • Sex chromosomes. • Sex determination in humans. • Sex linked traits. • Hereditary diseases e.g. hemophilia, sickle cell.	• Discussion on chromosomes, genes and DNA. • Explanation on sex determination in humans. • Brainstorm hereditary sex linked traits

	sperm and an egg (ovum). • Name the types of sex cells produced by a male and female. • Explain the 50:50 ratio of male: female in a population. • State the heredity diseases and sex inked traits.		
Mutation, variation and evolution (06 periods)	• Define the term mutation. • Explain the causes of mutation. • Explain the term variation. • Explain continuous and discontinuous variation. • Name types of variation. • Explain the causes of variation.	• Definition of mutation • Causes of mutation. • Definition of variation. • Causes of variations. • Definition of evolution • Theory on origin of life. • Natural selection. • Factors that cause natural selection. • Role of	• Discussion on mutation, types and causes • Brain storm on variation, types and causes. • Experimentation on variation • Discussion on origin of life and natural selection. • Explanation on the role of mutation,

	• Define evolution. • Explain natural selection and factors that favour it. • Demonstrate continuous and discontinuous variation using plotted graphs based on certain characteristics such as height and sex.	mutation, natural selection and adaptive changes in evolutionary changes. • Practical on continuous and discontinuous variation in class e.g. height, weight, sex, tongue rolling etc. • Evidence of evolution	natural selection in evolutionary changes
Topic 12: Inter-Relationships			
Food chains and food webs (08)	• Define ecology. • Explain the terms interrelationship, • population,	• Definition of ecology • Concept of interrelationship. • Components of the ecosystem.	• Explanation of ecology and ecosystem • Explanation of concept of interrelationship in

	producer, consumer, decomposer and community. • Explain the terms habitat, niche, prey, predator, carrying capacity and ecosystem. • State the different types of ecosystems. Explain what a food chain is. • Explain what a food web is. • Give an example of food web in illustrated diagrams.	• Food chain and foodweb. • Ecological pyramids: pyramids of umbers, biomass and energy. • Methods of quantitative sampling; • When and how to use such methods	ecosystems. • Field work and observation of the different ecosystems. • Discussion on food webs, food chains and ecological pyramids. • Review methods of quantitative sampling and their use.

	• Explain the various trophic levels in a food chain. • Explain the pyramid of numbers, pyramid of biomass and energy. • Explain the process of energy flow in the food chain and food web. • List the appropriate methods used to collect plants and animals in a habitat. • Use the methods		

	to collect and identify organisms in habitat.		
Changes in Population (09 periods)	• Define the term population. • Describe characteristics of a population. • State factors that affect population growth. • Interpret population growth curves. • List factors that affect human population growth. • Explain how plants and animals are adapted for the	• Definition of population • Characteristics of a population. • Factors that affect human population growth. • Population growth and growth curves. • Competition ; Types of competition . • Adaptations of plants and animals for various ecosystems. • Factors that enable plants and animals to inhabit new areas. • Succession and its stages.	• Discussion on population, its characteristics and factors that affect its growth. • Discussion on competition and types. • Explanation on adaptations of • plants for various ecosystems. • Brain storm on succession and its stages. • Practical work on succession on a cleared piece of land.

	different types of ecosystems • Explain the term competition • Distinguish between interspecific and intra – specific competition. • State factors that enable plants and animal to colonize new areas. • Explain what succession means. • Study and report the succession of a well cleared piece of land.	• Practical activity.	

Associations in organisms (09 periods)	• Explain symbiosis. • Name organisms that exhibit symbiosis. • Explain parasitism. • List characteristics of parasites and types. • List adaptations of parasites and methods of controlling them. • Outline measures to control tapeworm infestation. • mode of transmission of malaria parasite. • Name signs and symptoms of malaria • Outline control	• Definition of Symbiosis and examples • Parasitism, parasites and types. • Characteristics of parasites. • Adaptations of parasites to various environments. • Methods of parasite control. • Tapeworm, its life cycle and effects on the host. • Malaria, cause, mode of transmission, signs and symptoms and control measures. • Commensalism, its meaning and examples. • Tomato blight	• Discussion on symbiosis and types. • Explanation on parasitism. • Brain storm on parasites, types and their characteristics. • Discussion on cause, mode of transmission signs and symptoms and control of malaria. • Explanation of the term commensalism. • Discuss infection of the tomatoes by the blight fungus. • Practical work to study associations between organisms in

	measures for malaria. • List signs of presence of tomato blight fungus • Explain how the tomato blight is controlled.	fungus and its effects. • Practical activity – • - field study to find out some of the associations between living organisms.	the locality
Humans and natural environment (06 periods)	• List human activities that adversely affect the natural environment. • Name the natural resources. • Describe conservation methods for natural resources. • State what pollution is? • State types of pollution.	• Human activities – agriculture, lumbering, stone quarrying, swamp reclamation, charcoal making and fuel wood collection. • Natural resources • Methods of conservation of natural resources. • Importance of conservation of natural resources such as water, land, water forest	• Group discussions on human activities • Discussion on natural resources • Brainstorm on methods of conserving natural resources. • Discussion on pollution, pollutants and effects on living organisms and environment. • Field study to identify polluted areas in the

	• List different types of pollutants. • Describe the effects of pollutants on the environment. • Explain methods of pollution control.	and wild life. • Pollution and examples of pollutants. • Effects of pollutants to human life and the environment.	locality.

CHEMISTRY

SENIOR 4 ABRIDGED CHEMISTRY CURRICULUM

Introduction

This Abridged S4 Chemistry Curriculum involves critical reduction of the concepts to be learned by transferring some concepts to related topics in higher classes, reducing time spent on tasks by reducing the activities to be done and or putting related concepts together such that they are handled concurrently. All this is intended to ensure that the learner learns the critical concepts that can enable them progress to the next classes where much more detail will be done.

Based on this premise, for the S4 Abridged curriculum, a number of topics have been merged because of their relatedness, others have been removed since they are redundant, while some have been transferred to Physics.

Some of the critical changes include the following:

S/N	Changes	Justification
1	Laboratory preparation nitrogen and laboratory preparation of nitric acid – removed	It is a redundant concept.
2	Lab preparation of rhombic and monoclinic sulphur removed	It is not a critical concept.
3	Laboratory preparation of hydrogen sulphide – removed	It is not a critical concept.
4	Deducing the composition of hydrogen chloride and uses of hydrogen chloride – removed	Because it's a redundant concept.
5	Extraction of sodium and refining copper lifted from Applied chemistry transferred to electrolysis	They are similar concepts.
6	Alloys lifted from applied chemistry and transferred to metals under the Periodic Table.	as they are related
	Effect of electricity on substance merged with electrochemistry	as they are related concepts.
	Electrochemistry(cells) – removed and transferred to be handled in physics.	It is more applicable in Physics and Physics has been handling the same

The detailed syllabus is shown below.

TERM 1

Topic 1: Ionic chemistry and qualitative analysis (10 Periods)

Specific Objective	Content	TEACHING AND LEARNING STRATEGIES
Learners should be able to: ▪ Define an ion (cation and anion). ▪ Recognize the precipitates and complex ions produced by specified cation – anion reaction ▪ Differentiate between ions using a series of ionic reactions ▪ Define redox ▪ Explai n redox reactio	▪ Definition of an ion ▪ Precipitation reactions involving the following ions Mg^{2+}(aq), Ca^{2+}(aq), Fe^{3+} (aq), Zn^{2+} (aq), Cu^{2+} (aq), Fe^{2+} (aq), Al^{3+} (aq) with Cl^{-}(aq), OH^{-} (aq), CO_3^{2-}(aq) ▪ Complex ions; limited to dissolving of specific metal hydroxides in excess ammonia solution or sodium hydroxide formula of the following are required $Cu(NH_3)_4^{2-}$, $Pb(OH)_4^{2-}$, $Al(OH)_4$- ***Note: No instruction on equations is required.*** ▪ Redox reactions: ○ Definition (note changes in the charge of the ion)	• Discuss the definition of an ion • Carry out experiments to demonstrate precipitation reactions of the mentioned substances • Carry out experiments to demonstrate the formation of the specified complex ions and discuss the observations • Conduct a guided discussion on Redox reactions • Conduct experiments to demonstrate displacement reactions Conduct a guided discussion on reducing power, oxidizing power and the role of water in electrolysis.

n in term of electro n transfe r ▪ Compare the oxidizing and reducing power of ions from displacem ent and reactions ▪ Recognize the role of water in the products of electrolysis	○ Electron transfer. Useful illustrations, $Fe^{2+}(aq)$, $Fe^{3+}(aq)$ with $H_2O_2/H^+(aq)$ ▪ Displacement reactions as redox reactions (Balancing simple redox reactions) ▪ Reducing power: reaction of metal/cation ▪ Oxidizing power of halogens: Cl_2, Br_2, I_2 only ▪ The role of water in electrolysis products preferential discharge of hydrogen and oxygen, where appropriate from the following solutions: sodium chloride, dilute sulphuric acid (acidified water), magnesium sulphate.	

Topic 2: Energy changes in chemical processes (10 Periods)

Learners should be able to: • Define energy • Define exothermic and endothermic reactions using the enthalpy notation (ΔH) qualitatively • Explain that energy changes in chemical reactions are due to bond formation and bond breaking • Define and explain various types of heat or enthalpy changes • Carry out experiments to determine enthalpy changes for some reactions • Use data provided or obtained experimentally to calculate or graphically	• Definition of energy • Energy changes during physical changes. Molar heat of vaporization and boiling point (latent heats) as evidence for inter-particles forces • Enthalpy notation (ΔH) for exothermic and endothermic reactions • Enthalpy of chemical reactions Students should carry out simple quantitative work e.g. enthalpy of combustion (methanol, ethanol),	• Brainstorm on the definition of energy • Conduct experiments to demonstrate energy changes that occur during physical changes • Conduct a guided discussion on enthalpy notation for exothermic and endothermic reactions • Conduct experiments to demonstrate the various enthalpies of various chemical reactions • Demonstrate to the learners how a given enthalpy can be determined theoretically.

determine enthalpy changes. •	enthalpy of displacement (Cu^{2+} (aq) + Fe (s) enthalpy of solution (NaOH and conc H_2SO_4). ***(See the combustion of fuel and the internal combustion engine.)*** • Combustion of hydrocarbon fuel (practical work, charcoal, methylated spirit, butane and ethane) • Heat energy values of charcoal, fuel, oil, methylated spirit and natural gas. •	

Topic 3: Electrochemistry (5 Periods)

• Define electrolysis • Explain the migration of ions during electrolysis • Explain the factors that affect the preferential discharge of ions at an electrode • Explain electrolysis of given compounds in aqueous and molten form and give their products State the applications of electrolysis.	Definition of electrolysis Migration of ions to the cathode and anode Electrolysis of molten compounds e.g. lead(II) bromide Preferential discharge of ions. Electrolysis of aqueous solutions • dilute sulphuric acid (acidified water) • Sodium chloride • Copper (II) sulphate Application of electrolysis • Electrolysis of sodium chloride solution in industry - The castner-kellner cell • Manufacture of sodium hydroxide and chlorine.	• Conduct a guided discussion on the definition of electrolysis • Discussion the migration of ions to the cathodes and anode • Conduct experiments to demonstrate electrolysis of the specified molten compounds and aqueous solutions • Conduct guided discussion on the application of electrolysis.

Topic 4: Reaction rates and reversible reactions (10 Periods)

	Specific Objective	Content	TEACHING AND LEARNING STRATEGIES
	Learners should be able to: • Define rate of reaction • Describe some methods used to measure the rates of reaction • Explain the effect of different factors on reaction rates • Illustrate reaction rates graphically and explain the representation qualitatively using experimental data • Recall simple reversible reactions • Recognize the reversible sign and explain how reversible reactions reach a state of "balance".	• Definition of reaction rates • Reaction rate The effect of: concentration, pressure, temperature, surface area, light and catalysts on rate of reaction. Only qualitative, descriptive, graphical representation required, quantitative data given to illustrate a qualitative effect - Marble chips/dilute acids - Decomposition of H_2O_2 - Manganese (IV) oxide to catalyze H_2O_2 decomposition. - Plantinised asbestos to catalyze SO_2/O_2 combination.	• Discuss the definition of rate of reaction • Conduct experiments to demonstrate how different variables influence the rate of a given reaction • Discuss the observation of the above reaction with the aid of graphical representation • Conduct a guided discussion on reversible

		Note: Candidates will be expected to appreciate the applications of reaction rate to laboratory and industrial processes. • Reversible reactions Elementary treatment incorporating the idea that two-way reactions can reach a state of "balance", equilibrium is avoided. Examples: acids - alkalis plus indicator, chromate/dichromate, acid, hydrated and anhydrous copper (II) sulphate. ***Note: The effect of changing concentration, pressure, and temperature on position of equilibrium <u>NOT</u> required. The use in industrial processes should be regarded as optimum only (some sections in applied chemistry can be used as illustration i.e. Haber process, manufacture of nitric acid, contact process).***	reactions • Brainstorm on the use of reversible reactions in industrial processes.

TERM II

Topic 5: Nitrogen and its compounds (10 Periods)

Specific Objective	Content	TEACHING AND LEARNING STRATEGIES
Learners should be able to: • Outline the properties of nitrogen • Explain how nitrogen is isolated from air • Nitrogen compounds in the natural and industrial environment • Explain the importance of compounds of nitrogen in the natural and industrial environments • Explain the unreactive nature of nitrogen in comparison with oxygen	• Properties and tests of nitrogen • The nitrogen cycle ○ Converting nitrogen in the air to nitrates in the soil ○ Returning nitrogen to the soil from plants and animals ○ Returning nitrogen from the soil to the air • Elements necessary for plant growth • N, P, K, Ca, Mg, S • Reactions of nitrogen and oxygen with Na, Ca, P,S (Compare reactivity of nitrogen and oxygen) • Industrial preparation	• Carry out experiments to demonstrate the properties of nitrogen • Conduct a guided discussion on the nitrogen cycle • Assign learners group work on making presentations on the industrial preparation of nitrogen • Brainstorm on the uses of nitrogen • Conduct an experiment to prepare ammonia

	• State the uses of nitrogen • Explain how ammonia is prepared in the laboratory • Explain the differences in chemical reactions of ammonia gas and ammonia in aqueous solution • Explain how ammonia is manufactured • List the uses of ammonia • Explain the preparation and manufacture of nitric acid • Explain the reactions of dilute and concentrated nitric acid • Outline the uses of nitric	of nitrogen • Uses of nitrogen • Ammonia ○ The laboratory preparation of ammonia ○ Properties and tests of ammonia - Solubility in water • Reactions of ammonia gas - With air / oxygen (catalysed and uncatalysed), with copper (II) oxide, chlorine • Reactions of aqueous ammonia ○ Reaction of ammonia solution with dilute acids and metal ions • The industrial manufacture of ammonia – the Haber process • Uses of ammonia ○ Making fertilizers –	• Carry out experiments to demonstrate the properties of ammonia • Assign the learners group work on making presentations on the haber process • Brainstorm on the uses of ammonia • Carry out experiments to demonstrate the properties of nitric acid • Assign group work of making presentations on the industrial production

	acid • Name the products when different metal nitrates are heated • State the method of preparation of nitrates • Test for nitrates in the laboratory.	fertilizers as artificial replacements e.g. NO_2^-, $PO4^{3-}$, SO_4^{2-} Industrial production of nitric acid. • Reactions of nitric acid ○ Dilute: reactions with metals, carbonates, hydroxides, oxides ○ Concentrated: oxidising action, iron (II) solution, Sulphur, copper metal. • Acidic nature of nitrogen (IV) oxide industrial manufacture of nitric acid and its uses • Effect of heat on nitrates. ○ Action of heat on nitrates of Na, K , Cu, Pb, Ag.. • Test for nitrates • Brown ring test for nitrates. (Teacher demonstration only).	of nitric acid • Brainstorm o uses of nitric acid. • Carry out experiments to demonstrate the effect of heat on nitrates • Carry out an experiment to test for nitrates.

Topic 6: Sulphur and its compounds (12 Periods)

	Specific Objective	Content	TEACHING AND LEARNING STRATEGIES
	Learners should be able to: • Explain the extraction of sulphur from its ore • State the properties of Sulphur • State the allotropes of Sulphur • Outline how Sulphur reacts with oxygen, carbon, conc. nitric and conc. Sulphuric acid • Explain the preparation of Sulphur dioxide • State the properties of Sulphur dioxide • Outline the uses of Sulphur dioxide • Explain the pollution effects of	• Extraction of Sulphur (the frasch process) • The allotropes of Sulphur ○ Rhombic ○ Monoclinic • Chemical reaction of Sulphur • Reaction with non-metals: carbon, • oxygen • Reactions with concentrated acids: Conc. Nitric acid, Conc. Sulphuric acid. • Uses of Sulphur • Laboratory preparation of Sulphur dioxide (sulphite + acid). Relate method of collection to properties of the gas. • Properties of sulphur dioxide ○ Acid character. ○ Bleaching action ○ Test with potassium dichromate (VI). Note: *reducing action not required*.	• Discuss the extraction of sulphur • Conduct a guided discussion on the allotropes of Sulphur • Carry out experiments to demonstrate the properties of Sulphur. • Brainstorm on the uses of Sulphur. • Carry out experiments to demonstrate the properties of Sulphur dioxides. • Brainstorm

	sulphur dioxide on the environment • Describe the manufacture of sulphuric acid • State the uses of sulphuric acid • Explain the differences in chemical action between dilute and concentrated sulphuric acid. • Test for sulphates in the laboratory.	○ Combination with oxygen (laboratory demonstration; Pt. catalyst.) • Uses of Sulphur dioxide • Sulphur dioxide as a pollutant from the combustion of coal and heating oils. • The industrial manufacture of sulphuric acid – the contact process • Uses of sulphuric acid • Reactions of dilute sulphuric acid with metals, carbonates and bases • Reactions of concentrated sulphuric acid: dilution with water, copper (II) sulphate crystals, ethanol, sucrose. • Test for sulphates in solution with barium nitrate or barium chloride solution.	on the uses of Sulphur dioxide. • Conduct a discussion on a pollutant from combustion of fuels • Assign learners group work on the contact process • Brainstorm on uses of sulphuric acid • Conduct experiments to demonstrate the properties of dilute and concentrated sulphuric acid.

Topic 7: Chlorine and its compound (15 Periods)

	Specific Objective	Content	TEACHING AND LEARNING STRATEGIES
	Learners should be able to: • Describe and explain the laboratory preparation and manufacture of chlorine • Outline the properties of chlorine • Outline the uses of chlorine Learners should be able to: • Explain the preparation of hydrogen chloride in the laboratory • Explain	• Preparation of chlorine: Conc. HCl + Potassium manganate (VII) • Electrolysis of chloride solutions • Properties of chlorine gas - Reaction of chlorine with metals (Mg, Fe, Na, Zn) - Reaction of chlorine with non-metal (P, S) - Reaction of chlorine with: Water and dilute alkali. Bromides and iodides Bleaching action of chlorine - Uses of chlorine • Preparation of hydrogen chloride in laboratory	• Carry out an experiment to prepare chlorine • Discuss the industrial manufacture of chlorine • Carry out experiments to demonstrate the properties of chlorine • Brainstorm on the uses of Chlorine • Conduct an experiment to prepare hydrogen chloride • Carry out experiments to demonstr

	the properties of hydrogen chloride • Explain the effect of a solvent on the properties of hydrogen chloride • Test for chloride ions in the laboratory • State the uses of hydrochloric acid.	(Common salt +conc.H_2SO_4) • Properties of hydrogen chloride • Reaction of hydrogen chloride with ammonia gas • Behaviour of hydrogen chloride in water and methylbenzene • Test for chloride ions - Dry solid (action of Conc H_2SO_4) - Using barium nitrate and lead (II) nitrate - Using silver (I) nitrate solution - Uses of hydrochloric acid	ate the properties of hydrogen chloride. • Carry out experiments to test for the presence of chloride ions • Brainstorm on the uses of hydrochloric acid • Hold a discussion on domestic and industrial uses of water • Assign the learners group work on causes of water pollution • Discuss the definitions

			of hard and soft water • Discuss the causes of hard water and how to remove hardness in water • Conduct a field trip to a water treatment plant • Conduct a field trip to a sewage treatment plant.

TERM: III

Topic 8: Applied Chemistry (08 Periods)

	Specific Objective	Content	TEACHING AND LEARNING STRATEGIES
	Learners should be able to: • Describe the water treatment process • Describe the methods of sewage treatment • Outline the products of sewage treatment • Outline the application of electrolysis in sodium extraction • Describe	• Water treatment: filtration, fluoridation and desalination • Sewage: methods of sewage treatment; production of biogas (methane) and fertilizers The following processes should be used to illustrate: - - The chemical principles already covered in the course - The influence of the following factors (particular reference to East Africa) availability of raw materials, choice of site, social and economic factors, health and pollution problems, supply and demands • Extraction of metals - Sodium	• Discuss the extraction sodium – Highlight the application of electrolysis in the process • Discuss the extraction of iron Highlight the application of reduction in the processes • Discuss copper refining Highlight the application of electrolysis • Discuss the definition of alloy and the compositions of the alloys

	how iron is extracted by reduction • Outline how copper is refined by electrolysis • Define an alloy • State some common alloys and give their composition • Describe how sugar is manufactured in an industry.	Occurrence, extraction (downs cell). Uses of Sodium - Iron Occurrence, extraction, uses of iron (manufacture of steel). - Copper refining and uses of copper - Alloys of metals Examples of alloys, brass, solder, duralumin, bronze and steel their composition. • Large scale extraction of sugar from sugar cane: *Note: Use of very simple flow – charts of the processes should be encouraging.* • Some of the processes are covered in the previous topics from Senior one to Senior four.	that have been specified • Discuss how sugar is manufactured or conduct a field trip to a sugar manufacturing plant.

AGRICULTURE

ABRIDGED SYLLABUS SENIOR FOUR

RATIONALE OF THE AGRICULTURE SELECTED CONTENT FOR TEACHING

Agriculture teaching and learning at secondary school builds on the foundation made in primary school integrated science. Teaching agriculture in primary school introduces young people to basic scientific procedures of growing crops and rearing animals. It shows the learners how to apply these integrated science lessons into their daily lives. For example, a great primary school science teacher can teach pupils about the art and science of growing crops, rearing animals and processing both crop and animal products. This means that it is not only teaching learners how to be farmers, but also train tomorrow's scientists, nutritionists, processors, teachers and so much more.

The selection of the topics is done consciously to ensure that those who participate in secondary school agricultural training attain the skills necessary to become productive citizens as practitioners of crop and animal production. This lends itself into learning about tools, equipment, land tenure, farm building, farm structures and basic science. It implies a that agriculture puts machines, engineering, building technology, food processing, marketing, chemistry, biology and physics into everyday-life application.

The topics below emphasize a mix and a combination of classroom instruction and application of agriculture experiences outside the classroom. At the same time, these learners with this experience should be able to succeed in postsecondary education or the workforce for the labour market. The selection allows you to build the foundation for educated consumers and agriculturists.

SN	CRITICAL CHANGES	JUSTIFICATION
1	Change of Spiral Curriculum Design to one where related concepts are put together.	All topics in crop production and animal production have been combined. This is because in agriculture the emphasis is on growing crops, rearing animals and using the current knowledge of production. These learners had an opportunity to return to school before the second lockdown. They covered term one work for senior three. Teachers are advised to do remediation on crop production before starting on grassland management. Cattle production and farm structures in animal production are compulsory. In addition, teachers are advised to choose one other animal according to the resources available. The selection will be made from a list of two (2) topics. To teach agriculture practically, the school may not have all the resources, funds and space. Therefore, you are encouraged to seek opportunities of mobilizing the requirements from the community and stakeholders. You can make arrangements with the parents, donors, local governments to offer resources, land, funds and space for internship of your learners.

TERM ONE

Topic 1: Grassland management

GENERAL OBJECTIVE:

To enable the learner acquire knowledge and skills of establishing and managing grasslands for feeding livestock.

SUB TOPIC	SPECIFIC OBJECTIVES The learner should be able to:	CONTENT	TEACHING AND LEARNING STRATEGIES
1. Introduction to Grassland Management	- Distinguish between natural, improved and planted pastures. - Explain the factors that influence the availability of pastures.	- Grasslands: - Importance - Types of grassland (natural, improved and planted gesture / leys) - Characteristics of good pasture plants. - Factors influencing availability of pastures.	- Brainstorming on the importance of grasslands. - Guided discussion on the characteristics of natural, improved and planted pastures. - Observation of the characteristics of a good pasture. Discussion on the factors

			influencing of pasture.
2. Establishment of pure Grass pastures and Grass-legume mixed Pastures	- Carry out the recommended agronomic practices involved in the establishment and management of pastures. - Explain the importance of mixed pastures. - Explain the advantages of legumes in pastures.	- Establishment and management of pastures: - Seedbed preparation - Sowing - Inoculation of legume seeds - Fertilizer application - Weed control - Pest and disease control - Irrigation - Topping/ slashing - Importance of mixed pastures compared to leys. - Advantages of legumes in pastures.	- Demonstrations and practicals on methods of establishing a pasture and its maintenance. - Field tour to observe different types of pastures, how they are used and maintained. - Guided discussion on the importance of mixed pastures and the advantages of legumes in pastures.
3. Pasture Improvement	- Explain and demonstrate the various practices involved in the improvement of pastures	- Operations involved in pasture improvement: - Fencing and paddocking of grasslands - Weed control - Introduction of improved/ desirable species - Topping - Application of fertilizers and organic manures - Controlled burning of old pastures - Harrowing - Spot sowing and over-sowing pastures with	- Demonstration and practical session on the various operations performed to improve pastures. - Field visit to observe the various practicals in pasture improvement.

		legumes - Controlled grazing - Pest and disease control	
4. Grazing Management Systems.	- Explain the different practices used in grazing management	- Practices in grazing management: - Set stocking / continuous grazing - Rotation grazing - Strip grazing - Zero grazing - Deferred grazing - Advantages and disadvantages: -Stocking rates. -Carrying capacity.	- Guided discussion of the systems of grazing management and their advantages. - Field visit to observe the different systems of grazing management.
5. Herbage Conservation .	- Distinguish between hay and silage. - Describe the methods of making good quality hay and silage.	- Hay: - Importance - Procedure of making hay - Factors affecting quality of hay - Silage: - Types of silos used - Procedure of making silage - Factors affecting quality of silage	- Observation of hay and silage to identify their characteristics - Demonstration and practicals on hay and silage making - Project -on making livestock pellets, mineral blocks, hay and silage.
6. Important Pasture Species (grasses).	- Identify common pasture grasses by their local and scientific	- Pasture grasses: - Elephant grass (pennisetum purpureum) - Kikuyu grass (pennisetum cladestinum)	- Observation to identify and note the characteristics of various pastures

	names.	- Rhodes grass (chloris gayana) - Signal grass (bracharia spp) - Jaragua grass (hyparrhenia rufa) - Star grass (cynodon dactylon) - Nandi grass (seteria spp)	grasses. - Project on harvesting and preserving samples of pasture/ grasses.
7. Important Pasture Legumes.	- Identify common pasture legumes by their local and scientific names.	- Pasture legumes: - Glycine (glycine wightic) - Stylo (stylosanthes gracilis) - Green leaf desmodium (desmodium intortum) - Silver leaf desmondium (desmondium uncinatum) - Centro (centrosome pubescens) - Lucerne (medicago sativa) - Clovers (Trifollum spp) - Soratrp (Nacroptilium atropurpurenum) - Lab (lablab spp) - For each study plant characteristics, lifespan, mode of propagation feeding value.	- Observation to identify and note the characteristics of various pasture legumes. - Project on collecting and preserving samples of pasture/ legumes.

Topic 2: Cattle production

GENERAL OBJECTIVE:

To enable the learner manage cattle profitably.

SUB TOPIC	SPECIFIC OBJECTIVES The learner should be able to:	CONTENT	TEACHING AND LEARNING STRATEGIES
1 Importance of Cattle Keeping.	- Explain the ways in which cattle keeping is important to us.	- Importance of cattle keeping: - Food - Power - Income - Hides and skins - Raw materials for industries	- Discussion on the importance of keeping cattle.
2. Points of a Cow/Bull.	- Identify the parts of cow and bull.	- Points of a cow and bull.	- Observing and identifying the points on a cow/bull.
3. Breeds of Cattle.	- Describe the characteristics of the different breeds of cattle kept.	- Purposes of keeping the different breeds of cattle: - Dairy - Beef - Dual purposes	- Discussion of the purposes for which the different breeds are kept.
5. Reproduction in Cattle.	- Describe the male and female reproductive system in cattle. - Recognize the signs of heat, pregnancy and calving in a cow.	- Reproduction in cattle: - Male reproductive system - Female reproductive system - Signs of heat in females - Process of fertilization and implantation of the	- Observation and description of specimens of the male and female reproductive systems of a cattle. - Observing cows for signs of heat and calving. - Aiding a cow during calving.

	- Management of a pregnant cow..	embryo - Pregnancy (gestation) - Calving (parturition)	
6 Cattle Improvement	- Give reasons for improving cattle. - Describe the methods of improving cattle. - Compare and contrast natural mating and artificial insemination in cattle	- Cattle improvement: - Reasons for improvement - Methods of improving cattle (selection and breeding) - Hybrid vigor - Artificial insemination	- Discussion on the reasons for improving cattle and methods of improvement. - Demonstration of artificial insemination of a cow.
7 The Digestive System of Cattle	- Describe the parts of the digestive systems and process of digestion of cattle.	- The digestive system of cattle: - Parts of the digestive system of cattle - Digestion	- Observation, description and drawing of the parts of the digestive system - Discussion on the process of digestion in cattle.
8 Feeding and Nutrition in Cattle.	- Explain the nutrient requirements of cattle. - Identify the various types of food stuff given to cattle. - Outline the principles of feeding cattle.	- Feeding and nutrition in cattle. - Nutrients required by cattle (carbohydrates, proteins, lipids, vitamins, mineral salts). - Feedstuffs fed to cattle (water, roughages,	- Discussion on the nutrient requirements of cattle. - Observation and description of various feedstuffs. - Discussion of the principles of feeding. - Explanation of the terminologies used in animal nutrition.

	- Explain the meaning of the different terms used in animal nutrition.	concentrates, supplements). - Principles of feeding cattle (time, amount, economic returns, price of feeds, availability of feeds). - Terminologies used in animal nutrition (e.g. starch equivalent, production ration, maintenance ration, crude protein, supplementary feeding, dry matter, roughages, concentrates, digestibility, feeding standards).	- Feeding cattle.
9 Calf Rearing.	- Describe and carry out routine practices carried out in calf rearing.	- Calf reading: - -Immediate care after birth - -feeding - dehorning - -branding - -castration - housing - -Parasite and disease control	- Farm visits to observe demonstrations of calf rearing practices. - Carrying out calf rearing practices.
10 Other Cattle Management Practices.	- Describe while giving reasons for cattle management	- Management practices: - Grazing management. - Identification	- Discussion of the cattle management practices. - Demonstration of

	practices. - Carry out the cattle management practices.	(branding, tattooing, ear notching, ear tagging, belling). - Diseases and parasite control (dipping, spraying, hand picking, pyre greasing, de-worming). - Hoof trimming.	the cattle management practices.
11 Diseases and Parasites in Cattle	- Identify cattle parasites and explain their effects on cattle. - Describe the life cycles of cattle parasites. - Carry out measures to control parasites. - Describe spread, symptoms and control measures of cattle diseases. - Carry out measures to control cattle diseases.	- Meaning of the term parasite. - Cattle parasites; - Endo parasites (liver fluke, tape worms, round worms) - Ecto – parasites (tick, lice, mites, fleas). - Cattle diseases: - Viral diseases - Bacterial diseases - Protozoan diseases - Note: study in detail each of the diseases in relation to causal organism, symptoms, spread and control measures.	- Brainstorming on the meanings of parasite and disease. -Observation of specimens of parasites - Observation of cattle to identify effect of parasites on them. - Discussing the effects, life cycles, and methods of parasite control. - Practicing methods of controlling parasites. - Discussion on the spread of cattle diseases and control measures. - Observation of sick animals to identify diseases affecting them. - Practicing disease control measures.

TERM TWO

Topic 3: Farm implements and equipment

GENERAL OBJECTIVE:

To enable the learner correctly use and care for farm implements and equipment

SUB TOPIC	SPECIFIC OBJECTIVES The learner should be able to:	CONTENT	TEACHING AND LEARNING STRATEGIES
1. Tillage Implements	- Identify and use the various tillage implements . - Maintain tillage implements	- Tillage implements: - Primary tillage implements (tractor drawn disc and mould board ploughs and ox-ploughs). - Secondary tillage implements. - Advantages and disadvantages of ox-cultivation - Conditions favouring ox-cultivation Ox-drawn implements	- Demonstrate and relate the working of the tractor and its systems when handling tillage implements used on the tractor. - Observation of tillage implements. - Carrying out maintenance practices on tillage implements. - Generate records when handling tillage implement. - Demonstrate how to observe health and safety standards when handling tillage implements.
2. Planting Equipment	- Identify planting	- Planting equipment:	- Observation of planting equipment.

	equipment, maintain and use them correctly	- Hand pushed - Animal drawn - Tractor drawn	- Demonstrating the use of planting equipment. - Practicing the use of planting implements. - Carry out maintenance work on planting equipment. - Generate records when handling planting equipment. - Demonstrate how to observe health and safety standards when handling planting equipment.
3. Spraying Equipment	- Identify, use and maintain spraying equipment	- Spraying equipment: - Hand sprayer e.g. knapsack - Mechanized sprayer e.g. plantector.	- Observation of spraying equipment to identify parts - Demonstration of the use of spraying equipment. - Practicing the use of spraying equipment. - Maintaining spraying equipment. - Generate records when handling spraying equipment. - Demonstrate how to observe health and safety standards when handling spraying equipment.
4.	- Identify and	- Harvesting	- Observing harvesting

Harvesting Equipment and Machines	correctly use harvesting equipment and machines	equipment and machines: - Cotton picker - Ground nut lifter - Combine harvester - Potato lifter	equipment and machines. - Demonstrating use of harvesting equipment. - Practice the use of harvesting equipment. - Generate records when handling harvesting equipment and machines. Demonstrate how to observe health and safety standards when handling harvesting equipment and machines.
5. Processing Equipment	- Identify and use processing equipment	- Processing equipment: - Threshers - Winnowers - Mills - Mortar and pestle - Sieves	- Observation of harvesting equipment. - Demonstration of use of processing equipment. - Generate records when handling processing equipment. - Demonstrate how to observe health and safety standards when handling processing equipment.

TERM THREE

Topic 4: Agricultural economics

GENERAL OBJECTIVES:

To enable the learner acquire an understanding of the principles of economics and how they affect agricultural production

SUB TOPIC	SPECIFIC OBJECTIVES The learner should be able to:	CONTENT	TEACHING AND LEARNING STRATEGIES
1. Principle of Agricultural Economics	- Explain the factors of production in relation to agricultural production. - Explain the law of diminishing returns and how it affects profit maximization. - Distinguish between various costs of production. - Distinguish between risks, uncertainties and how they	- Factors of production: - Meaning of economics - Factors of production - Production function - The law of diminishing returns - Profit maximization - Costs of production. - Risks and uncertainties. - Product combinations: - Enterprise selection and combination - Efficiency standard - Specialization and diversification	- Guided discussion on factors of production. - Use of graphs and charts to illustrate the law of diminishing returns and other concepts. - Guided discussion on costs of production, risks and uncertainties, enterprise selection and combination; efficiency standards, specialization and diversification.

	affect production. - Explain enterprise selection and combination.		
2. Price Theory	- Demonstrate the relationship between supply, demand and the price of a commodity. - Explain the reason for price fluctuation of agricultural commodities and how they can be averted.	- Demand, supply and pricing - Meaning - Law and demand and supply - Prices in agriculture: - Importance - Price fluctuation of agricultural products; why prices fluctuate, solutions to causes of price fluctuation.	- Use of graphs to illustrate the relationship between supply and demand. - Guided discussion on supply, demand and price.
3. Marketing of Agricultural Produce	- Outline marketing functions and problems of agricultural marketing.	- Marketing of agricultural produce - Marketing function - Problems of agricultural marketing - Marketing boards	- Guided discussion on marketing functions. - Group discussion on the problems of agriculture marketing.
4. Budgeting	- Explain the importance of farm budgeting. - Distinguish between the type of budgets	- Farm budgeting: - Importance - Types - Sources of data for budgeting - Procedure of	- Teacher guided discussion and explanation on budgeting.

	namely partial and complete budgets. - Follow the correct procedure in making a farm budget	making a budget - Constraints in budgeting	
5. Agricultural Credit	- Name the types and source of agricultural credit. - Explain the administration of agricultural credit. - Explain the ways of making agricultural credit effective.	- Agricultural credit: - Types: long term, short term, medium term, hard credits, soft credits. - Sources - Interest rates on credit and repayment policies - Ways of making agricultural credit effective	- Guided discussion on agricultural credit, its sources and administration. - Group discussion and presentation on causes, failure to pay back agriculture credit. - Guided discussion on ways of making agricultural credit effective. - Organize learners to interview members of a credit and saving organization to learn how credit is accessed.
6. Population Density and its effects on Agriculture	- Explain the effects of high population density on human welfare and farming.	- Population density: - Meaning - Effects of high population density on farming.	- Use of national population records to explain population growth and its effects on the country's economy.
7. Cooperatives	- Explain the importance and principles of the working	- Cooperatives: - Importance of farming cooperatives - Principles	- Discussion on the various aspects of cooperatives. - Field visit to a cooperative society

	of cooperatives. - State the types and describe the organization of cooperatives.	- Organization - Types of cooperatives	to study its organization and operation in relation to farming.

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