

**REPUBLIC OF RWANDA**



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**ADVANCED LEVEL BIOLOGY CURRICULUM  
(PRINCIPAL SUBJECT)  
(Form 4, 5 & 6)**

**Kigali, June 2010**

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## **BIOLOGY TEACHING CURRICULUM**

This curriculum of Biology has been elaborated during a workshop on the revision of secondary education curricula held in Kigali, from 14 May to 4 June 2010. The team of participants in A- level Biology curriculum development process is composed of the following members;

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## 1. INTRODUCTION

Ever since advanced level Biology curriculum was put in place in 1999, it has not been revised. The NCDC carried out an evaluation exercise of Biology, principal subject for advanced level students before its revision. The evaluation exercise was carried out in various schools in the country and was found to have some imperfections. The major aim was to present to users quality curriculum which match with contemporary issues.

With regard to teachers' views and NCDC scrutiny of current curriculum, it has been clear that:

1. Some useful chapters were missing
2. Some existing chapters were lacking in content
3. The content was not well distributed in different levels

In accordance with the few new changes in educational policy in 2009, teachers' recommendations and evaluation report which triggered the reform of national curriculum, it was also decided to revise the former advanced level Biology curriculum. In so doing, some

contents were transferred from S6 to S5; the number of periods was equally distributed with seven (7) periods per week in each level and missing chapters added.

The content of curriculum is limited to each grade level, activities and methodology are proposed. The curriculum is presented in a table with three columns. The first column refers to specific objectives within chapters. The second column comprises the contents, and last column contains a methodological note which is composed of teaching - learning activities, that lead to attainment of objectives.

This Biology curriculum will develop students in a more special way the following qualities than it did in Ordinary Level: observations, critical, logical thinking and analysis, commitment to work and perception of the abstract, adjustment of mentality towards HIV/AIDS, malaria... It will bring students to understand diversity and complexity of living organisms, and relations existing in environment or between concepts, addressing questions as well as resolving problems.



## **II. GENERAL ORIENTATIONS**

In vision 2020, Rwanda has decided to build on a knowledge – based economy, where science, technology education and ICT skills are actively encouraged and considered as the engine for development of the country.

In this frame work, the government is committed to review all the curriculum of all levels and teaching methodology to provide the population with knowledge, competences and attitudes for sustainable development.

The current curriculum is the continuation of Ordinary Level curriculum regarding content and methodological approach to strengthen the acquired knowledge.

The major change made to new biology curriculum is that, teaching must be learner – centered and integrate theory and practice: laboratory manipulations, experiments and observation of real situation.

The revision of this curriculum is inspired by the following didactic principles:

- ***Principle of motivation***

Etymologically, the word motivation comes from Latin "*motivus*" that means motive which puts in movement. It is a group of internal forces (desire, will) that push individual to act, to accomplish a task or to attain an objective corresponding to the need.

The motivation directs, channels the behaviour toward a goal. In the beginning of every chapter / theme, the teacher must foresee a learning situation. By analogy, at the level of the lesson, in the beginning, the teacher must endeavour to create the problem situation that place the learner in a learning mood.

- ***Principle of activity***

This principle stipulates that, individual learns better if he/she is entirely implicated in the action. The biology curriculum puts emphasis on a learner centered approach. It integrates in the column of learning activities, a whole set of activities among which should be achieved by the learners themselves to reach scientific truth (laws, theories,) that traditional pedagogy has habit to expose / impose.

- ***Principle of realization***

To teach, it is necessary to start from concrete to abstract, from specific to general. The reality gives a sense to situation and permits to understand a situation by reference to a known and familiar context. Even though during adolescence, an individual reaches a hypothetic-deductive reasoning allowing him/her to start from general to specific (deductive way), teaching experience recommends even at this age the inductive way which orients the learner toward the discovery. The biology curriculum proposes and recommends the use of learning situations and activities that are placed in a familiar, meaningful context because they evoke lively learning situation for the learner. A meaningful context creates interest and motivation.

- ***Principle of progression***

The principle of progression makes reference to logical sequence that must characterize the organization of content in the curriculum and text book. Every time start from simple to complex, from known to unknown. It is mathematical progression. This principle makes also reference to learner's psychological progression, his/her mental development level.

- ***Principle of cooperation***

This principle includes one mode of school organization. In a cooperative training, competition and individualization don't have any place. We have a group centered on a task to achieve. Everybody is there to learn from each other, to take advantage of the enriching experience of his/her classmates.

- ***Principle of transfer***

For L. D'HAINAUT, the transfer is the capacity to put in work knowledge or skill in situations which are different from the one used in the learning process. By this principle, science teaching recommends that acquired notions should be applicable in real and new life situations.

- ***Principle of integration of matter***

Education constitutes a unit. All disciplines of science (Biology, Chemistry, Physics and Mathematics) contribute to promotion of student knowledge, competences and attitudes and propose some solutions to complex problems of life in general. Even if these disciplines are taught separately at this level, the teacher will have to make reference to them during lessons.

### **III. GENERAL OBJECTIVES**

At the end of Advanced level, learners should be able to:

1. Perceive biological diversity, its structural and functional complexity, its protection and interaction in nature.
2. Acquire basic theoretical, practical as well as methodological knowledge concerning natural facts.
3. Transfer and apply biological knowledge in a precise, concise and logical way.
4. Develop capacity to seek information for on his/her own, to explore the unknown, synthesize and interpret data, state hypotheses and express himself/herself in a good and clear language.
5. Participate actively and with ease in the community life and develop attitudes to help people, to prevent and fight against infectious diseases particularly HIV/AIDS and malaria.
6. Acquire principal scientific qualities namely:
  - (i) capacity to observe phenomena objectively
  - (ii) critical attitudes in observations
  - (iii) capacity to analyze and comprehend biological facts, critical thinking, critical analysis and logical interpretation of facts, commitment to work, the will to communicate research findings
7. Undergo higher studies at university level and other higher learning institutions.

**BIOLOGY CURRICULUM FORM FOUR  
(PRINCIPAL SUBJECT)**

**7 periods / week**

**GENERAL OBJECTIVES**

At the end of form four, learners should be able to:

1. Apply general principles of classification to explain diversity of living organisms
2. Explain and relate structures of living organisms to their functions and ecological habitat
3. Differentiate living organisms in their environment basing on their morphological features

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENTS</b>	<b>METHODOLOGY NOTES</b>
<p>At the end of the chapter, learner will be able to:</p> <p>1.Explain main principles of classifying living organisms</p> <p>2. Differentiate five kingdoms of organisms and name two examples.</p>	<p><b>CHAPTER 1: CLASSIFICATION AND DIVERSITY OF LIVING ORGANISMS</b></p> <p><b>1.1 Taxonomy.</b>            Explain the following terms:            Taxonomy            Identification            Nomenclature            Classification            Necessity and significance of classification            Dichotomous keys, their use and construction</p> <p><b>1.2. Kingdoms of living organisms:</b></p> <ul style="list-style-type: none"> <li>- Kingdom monera: e.g. bacteria, blue algae (Cyanobacteria)</li> <li>- Kingdom prototista: e.g. Amoeba, paramecia</li> <li>- Kingdom Fungi: e.g. Mushroom, yeasts</li> </ul>	<ul style="list-style-type: none"> <li>- Guided by the teacher, students collect different specimens of organisms in the environment and group them according to their differences and similarities</li> <li>- Students may use different teaching aids such as magnifying lenses, microscopes, wall papers....</li> <li>- Collection of specimens such as seeds, insects, leaves, e.t.c to construct simple dichotomous keys.</li> </ul>

<p>3. Recall seven taxa in their order and apply them to man</p>	<ul style="list-style-type: none"> <li>- Kingdom Plantae: Beans, ferns</li> <li>- Kingdom animalia: Man, snails</li> </ul> <p><i>NB. Viruses are classified neither among living nor non living organisms.</i></p> <p><b>1.3. Taxonomic hierarchy;</b>  Kingdom, Phylum, Class, Order, Family, Genus, Species.  E.g. Classification of man  Kingdom : Animalia  Phylum: Chordata  Class: Mammalia  Order: Primate  Family: Hominidae  Genus: Homo  Species: <i>Homo sapiens</i></p>	<ul style="list-style-type: none"> <li>- Teacher guided discussion</li> <li>- Use different specimens ( live specimens collected by students, dead preserved specimens) and other teaching aids e.g. charts</li> </ul>
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<p>4. Identify divisions of Kingdom plantae</p> <p>5. Identify different parts of a flowering plant</p> <p>6. Identify and locate different parts of a root</p> <p>7. Describe external structure of a root of a flowering plant</p>	<p><b>CHAPTRE 2. PLANT KINGDOM</b></p> <p><b>Divisions of the Plant Kingdom</b></p> <ul style="list-style-type: none"> <li>- Flowering plants (phanerogams)</li> <li>- Non- flowering plants ( cryptogams)</li> </ul> <p><b>2.1. Phylum Flowering plants (phanerogams)</b></p> <p><b>2.1.1. Description of plant parts</b></p> <p>Parts of a flowering plant</p> <p>Roots, stems, leaves, flowers, fruits and seed</p> <p>2.1.1.1. Vegetative organs</p> <p><i>(a) Roots</i></p> <p>Different parts of a root.</p> <p>External structure of a monocotyledonous root</p> <p>External structure of a dicotyledonous root</p>	<ul style="list-style-type: none"> <li>- Students collect and observe flowering plants (bean) and a non flowering plant (moss) to show the differences.</li>   <li>- Students collect, observe, and recognize different types of roots from the school botanical garden.</li> </ul>
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8. Distinguish between external structure of monocotyledonous and dicotyledonous roots	Difference between external structure of monocotyledonous and dicotyledonous roots	Observation of the external structure of monocotyledonous and dicotyledonous roots collected from the school botanical garden Use of hand lenses and wall charts.
9. State the types of roots and their importance	Types of roots and importance comparison of collected roots	
10. Compare collected different types of roots		
11. Describe external structure of monocotyledonous and dicotyledonous stem.	<i>(b) Stems</i> External structure of a monocotyledonous and dicotyledonous stem.	- Students collect from the school botanical garden / around the school compound and observe the external structure of monocotyledonous (maize)and dicotyledonous (bean) stems
12. Identify and locate different parts of a stem.	Parts of a stem and their location	

13. Distinguish between external structure of monocotyledonous and dicotyledonous stems	Difference between external structure of monocotyledonous and dicotyledonous stem	- Observe and recognize different parts of monocotyledonous and dicotyledonous stems Use of wall charts
14. State types of stems and their importance.	Types of stems and importance	
15. Compare different types of stems collected	Comparison of different types of stems collected	- Comparison of collected stems
16. Describe external structure of a monocotyledonous and dicotyledonous leaf	<i>( c ) Leaves;</i> External structure of a monocotyledonous and a dicotyledonous leaves	- Students draw external features of monocotyledonous and dicotyledonous leaves: maize and bean
17. Differentiate a monocotyledonous	- Differences between a monocotyledonous and dicotyledonous leaves.	- Comparison between a monocotyledonous and

<p>leaf from a dicotyledonous leaf</p> <p>18. State different types of leaves</p> <p>19. Compare different types of leaves</p> <p>20. Explain importance of leaves</p> <p>21. Explain leaf modifications in relation to their function</p>	<p>Types of leaves according to:</p> <ul style="list-style-type: none"> <li>- the lamina shape</li> <li>- the venation</li> <li>- the presence or absence of a petiole</li> <li>- the leaf arrangement on the stem (Phyllotaxis)</li> <li>- the number of leaflets</li> </ul> <p>Comparison of different types of leaves</p> <p>Importance of leaves</p> <p>Leaf modifications</p>	<p>dicotyledonous leaves.</p> <ul style="list-style-type: none"> <li>- Students collect, observe and draw different types of leaves</li> <li>- Use of charts</li> <li>- Learners are advised to search on the Educational website during their free time to find out additional information on vegetative organs of the plant.</li> <li>- Learners may use computer software programs (e.g. paint) to draw plant organs.</li> </ul>
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<p>22. Describe different parts of a flower and their role</p> <p>23. Define and draw floral diagram and floral formula of a flower and give floral diagram and formula of <i>Hibiscus</i> flower</p> <p>24. Define and identify different types of inflorescence</p>	<p>2.1.1.2. Reproductive organs</p> <p><i>(a) Flowers</i></p> <p>Parts of a flower and roles (Perianth, Androecium, Gynaecium)</p> <p>Floral diagram Floral formula Floral diagram and formula of <i>Hibiscus</i></p> <p><i>(b) Inflorescence</i></p> <p>Types of inflorescence</p>	<ul style="list-style-type: none"> <li>- Students collect <i>Hibiscus</i> flowers, draw and label different parts</li> <li>- Students give the floral formula and draw the floral diagram and give the floral formula of <i>Hibiscus</i></li> <li>- Under the guidance of a teacher, students identify different inflorescence types.</li> </ul>
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<p>25. Explain process and state agents of pollination</p> <p>26. Differentiate types of pollination.</p> <p>27. Explain process of fertilization</p> <p>28. Explain process of fruit formation</p> <p>29. Establish relation between flower and fruit parts</p> <p>30. Describe structure of a fruit</p> <p>31. Identify different types of fruits according to mode of dehiscence,</p>	<p><b>2.1.2. Reproduction in Flowering plants</b></p> <p>2.1.2.1. Sexual reproduction</p> <p><i>(a)Pollination</i></p> <p>Pollination agents</p> <p>Types of pollination</p> <p>Fertilisation</p> <p><i>(b) Fruits</i></p> <p>Fruit formation</p> <p>Relation between the fruit and the flower parts</p> <p>Fruit structure</p> <p>Types of fruits according to the mode of dehiscence</p> <p>Types of fruits according to the texture of the pericarp</p> <p>Types of fruits according to the number of</p>	<p>- Use charts</p> <p>- Students collect fruits and establish relation between fruits and flowers parts</p> <p>- Observe avocado fruit and distinguish its different parts</p> <p>- Recognize and draw types of fruits collected</p>
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<p>structure of pericarp and number of carpels of the flower</p> <p>32. Explain role of a fruit in life history of a plant</p> <p>33. Define a seed and describe structure of a monocot and a dicot seed</p> <p>34. Identify different types of seeds</p> <p>35. State role of a seed in life history of a plant</p> <p>36. Describe main mechanisms of seeds dispersal and</p>	<p>carpels</p> <p>Role of a fruit in a plant's life</p> <p><i>(c) Seed</i></p> <p>Definition of a seed</p> <p>Structure of a monocot grain: Maize</p> <p>Structure of a dicot seed: Bean</p> <p>Types of seeds</p> <p>Role of a seed in the plant's life</p> <p>Dispersal of seeds</p> <p>Mechanisms of seed dispersal</p> <p>Seeds dispersal agents</p>	<ul style="list-style-type: none"> <li>- Students collect seeds</li> <li>- Dissect bean and maize seeds; observe, draw and label the different parts</li> <li>- Students discuss structural adaptations of seeds in relation to their modes of dispersal in groups.</li> <li>- Keep bean seeds into water for a night and observe the radicle</li> </ul>
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<p>state agents of seeds dispersal</p> <p>37. Define germination and explain conditions of germination.</p> <p>38. Outline stages of germination.</p> <p>39. Differentiate types of germination</p> <p>40. Explain different modes of asexual reproduction in flowering plants</p>	<p>Definition of germination Conditions for germination</p> <p>Stages of germination</p> <p><b>Types of germination</b> (epigeal and hypogeal )</p> <p>2.1.2.2. Asexual reproduction Natural reproduction Artificial reproduction</p> <ul style="list-style-type: none"> <li>- Cutting: cassava</li> <li>- Grafting: avocado tree</li> <li>- Layering: <i>Fragaria</i> (strawberry)</li> </ul>	<p>-Use charts showing hypogeal and epigeal germination.</p> <p>- Guided by the teacher, students plant some cuttings and observe their germination.</p> <p>- Have students visit botanical gardens and research centres.</p>
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<p>41. Describe and draw structure of bean and maize.</p> <p>42. Classify bean and maize up to order and give their importance.</p> <p>43. Describe and draw structure of <i>Cupressus species</i></p> <p>44. Classify <i>Cupressus species</i> up to order and give its importance</p>	<p><b>2.1.3. Classification of phanerogams (flowering plants)</b></p> <p>2.1.3.1. Sub-phylum of Angiosperms: Description of bean and maize: general aspect, different parts, ecology and importance Classification of bean and importance Classification of maize and importance</p> <p>2.1.3.2. Sub-phylum of Gymnosperms: Description of <i>Cupressus species</i>.: general aspect, different parts, ecology and importance</p> <p>Classification of <i>Cupressus species</i> and importance</p>	<p>-Draw structure of a bean and a maize</p> <p>-Draw structure of <i>Cupressus species</i></p>
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<p>45. Name main features of pteridophytes</p>	<p><b>2.2. Non - flowering plants ( Cryptogams)</b>  <b>2.2.1. Phylum: Pteridophytes (Ferns)</b>  2.2.1.1. General features of pteridophytes</p>	<p>- Students collect <i>Nephrolepis</i> or <i>Pteridium</i>, observe their different parts and features</p>
<p>46. Describe fern <i>Nephrolepis</i> or <i>Pteridium</i></p>	<p>2.2.1.2. Description of <i>Nephrolepis</i> or <i>Pteridium</i>  Vegetative structure  Reproductive structure  Ecology</p>	<p>Draw and label reproductive organs of <i>Nephrolepis</i> or <i>Pteridium</i></p>
<p>47. Explain sexual and asexual reproduction of the pteridophytes and their life cycle</p>	<p>Sexual reproduction of pteridophytes (<i>Nephrolepis</i> or <i>Pteridium</i>) &amp; life cycle  Asexual reproduction of pteridophytes (<i>Nephrolepis</i> or <i>Pteridium</i>)</p>	
<p>48. Classify <i>Nephrolepis</i> and <i>Pteridium</i> up to order</p>	<p>2.2.1.3. Classification  Classification of <i>Nephrolepis</i>  Classification of <i>Pteridium</i></p>	

<p>49. State some other pteridophytes and their habitat</p>	<p>2.2.1.4. Other pteridophytes and their habitat</p> <ul style="list-style-type: none"> <li>- <i>Equisetum</i></li> <li>- <i>Lycopodium</i></li> <li>- <i>Selaginella</i></li> </ul> <p><b>2.2.2. Phylum: Bryophytes</b></p>	
<p>50. Name general features of bryophytes</p>	<p>2.2.2.1. General characteristics of bryophytes</p>	
<p>51. Describe vegetative structure of <i>Polytrichum</i> or any other moss</p>	<p>2.2.2.2.Example : Mosses(class Bryopsida) Description of <i>Polytrichum</i> or any other moss <i>Polytrichum</i> reproductive structure</p>	<p>- Students collect mosses, observe ecology, vegetative and reproductive structures</p>
<p>52. Describe reproductive structure and the reproduction of <i>Polytrichum</i> and explain its life cycle</p>	<p><i>Polytrichum</i> reproduction <i>Polytrichum</i> life cycle</p>	
<p>53. State importance of mosses</p>	<p>Importance of mosses</p>	

54. Explain ecology of mosses	Ecology of mosses	
55. Describe briefly other bryophytes	2.2.2.3. Other bryophytes	
56. Compare phylum of Pteridophytes and phylum of Bryophytes	Comparison between Pteridophytes and Bryophytes (mosses) with respect to: - Vegetative structure - Reproductive structure - Life cycle - Ecology	
57. Classify <i>Polytrichum</i> up to order level	<i>Polytrichum</i> classification	
58. Name the general features of Phycophyta	<b>2.2.3. Phylum : Phycophyta (algae)</b> 2.2.3.1. General characteristics	- Collect water from a swamp and observe <i>Spirogyra</i> on a microscope. Draw the filaments of the algae
59. Describe the vegetative structure of <i>Spirogyra</i> ( green alga)	2.2.3.2. Example: <i>Spirogyra</i> Vegetative structure Sexual reproduction	

<p>60. Explain asexual and sexual reproduction in Spirogyra, and its life cycle</p>	<p>Asexual reproduction Life cycle</p>	
<p>61. Classify algae according to their pigments</p>	<p>2.2.3.3. Classification of algae in relation to the pigment : green, brown, blue - green, brown</p>	
<p>62. Identify the importance of algae</p>	<p>Utility of algae</p> <ul style="list-style-type: none"> <li>- Organic matter (green algae) and oxygen</li> <li>- Production of gels</li> <li>- Atmospheric nitrogen fixation</li> <li>- Food production</li> </ul>	<p>NB. <i>Emphasize on autotrophic nutrition in algae</i></p>
<p>63. Describe general characteristics of the lichens</p>	<p><b>2.2.4. Phylum : Lichens</b> 2.2.4.1. Characteristics</p>	<p>- Students collect lichens from trees trunks, observe them with lenses</p>

<p>64. Describe the ecology of <i>Parmelia</i></p>	<p>2.2.4.2. Ecology  2.2.4.3. Structure of a lichen (<i>Parmelia</i>)  Macroscopic structure : thallus, rhizines, apothecia  Microstructure: hypha, gonidia</p>	<p>- Use microscopic slides, charts</p>
<p>65. Describe macroscopic and the microscopic structures of a lichen</p>	<p>2.2.4.4. Reproduction  Sexual reproduction  Asexual reproduction</p>	
<p>66. Explain mode of reproduction and the life cycle of lichens</p>	<p>Life cycle :</p>	
<p>67. Identify importance of lichens</p>	<p>Importance of lichens</p>	

	<b>CHAPTER 3. FUNGI KINGDOM</b>	
68. Enumerate general features of fungi	<b>3.1. Microscopic fungi (Mycophytes)</b> - General characteristics of fungi <b>3.1.1. Class : Zygomycetes (Phycomycetes)</b>	
69. Describe general features of Zygomycetes (Phycomycetes)	3.1.1. 1. General characteristics	
70. Observe on microscope, describe the filaments of black mould of bread and draw filaments	3.1.1. 2. Description of black mould of bread ( <i>Rhizopus nigricans</i> )	- Students observe and draw black mould of bread ( <i>Rhizopus nigricans</i> ) filaments on microscope - Use charts
71. Describe asexual and sexual reproduction, and the life cycle of <i>Rhizopus nigricans</i>	- Sexual reproduction - Asexual reproduction - Life cycle  <i>Rhizopus nigricans</i> classification	

<p>72. Classify <i>Rhizopus nigricans</i> up the order level</p> <p>73. List other Zygomycetes</p> <p>74. Describe general features of Ascomycetes</p> <p>75. Explain conditions for growth of <i>Penicillium</i> in a laboratory</p> <p>76. Describe structure of <i>Penicillium species</i></p> <p>77. Explain asexual reproduction and life cycle of <i>Penicillium species</i></p>	<p>3.1.1.3. Other Zygomycetes - <i>Mucor</i></p> <p><b>3.1.2 Class : Ascomycetes</b></p> <p>3.1.2.1.General features</p> <p>3.1.2.2. Example: <i>Penicillium sp</i></p> <p>Conditions favourable for culturing <i>Penicillium</i> in a laboratory</p> <p>Microscopic structure: thallus, conidia and conidiophores</p> <p>Asexual reproduction</p> <ul style="list-style-type: none"> <li>- Conidia formation</li> <li>- Conidiospores release</li> <li>- Spores germination</li> </ul> <p>Life cycle of <i>Penicillium sp</i></p> <p><i>Pennicillium</i> classification</p>	<p>- Culture of <i>Penicillium species</i> in a laboratory</p> <p>- Microscopic observation of <i>Penicillium species</i>; students draw a thallus, conidia and conidiophores</p>
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<p>78. Classify <i>Penicillium</i> species up to order level</p>		
<p>79. Compare the mycelia of Zygomycetes and Ascomycetes</p>	<p>Comparison of zygomycetes and Ascomycetes.</p>	
<p>80. Give economic importance of moulds (both usefulness and nuisance)</p>	<p>Economic importance of microscopic fungi:</p> <ul style="list-style-type: none"> <li>- Use of yeast in fermentation</li> <li>- Production of antibiotics</li> <li>- Industrial uses</li> <li>- Mycorrhizas</li> </ul> <p>Nuisance of microscopic fungi:</p> <ul style="list-style-type: none"> <li>- Cause diseases to humans, animals and plants (e.g. Ringworms, Athlete's foot, smuts and rusts)</li> <li>- Food reserve destruction</li> </ul>	

<p>81. Describe general features of basidiomycetes</p> <p>82. Describe vegetative structure of a club fungi</p> <p>83. Explain sexual and asexual reproduction of a basidiomycete and its life cycle</p> <p>84. Explain importance and ecology of basidiomycetes</p>	<p><b>3.2. Macroscopic fungi</b></p> <p>3.2.1.Example: Class Basidiomycetes</p> <p>Example : Club fungi Vegetative structure (carpophore) : velum, gill, lamella(hymenium), pileus, stipe</p> <p>Sexual reproduction Asexual reproduction Life cycle</p> <p>Utility or nuisance of basidiomycetes Ecology</p>	<p>- Student collect club fungi, draw and label the vegetative structure</p> <p><i>Remind students that there is no absolute characteristic to distinguish edible and poisonous mushrooms</i></p>
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85. Give any other examples of basidiomycetes	<b>3.2.2. Other Basidiomycetes:</b> <i>Puccinia graminis</i> : causes wheat rust Obligate heterotrophism:	
86. Explain obligate heterotrophism among fungi		
87. State general characteristics of protoctista.	<b>CHAPTER 4.</b> <b>PROTOCTISTA KINGDOM</b>  <b>4.1. Characteristics</b>	
88. Give a simple classification of common protoctista	<b>4.2. Simple classification</b> - Flagellates ( <i>Euglena</i> , trypanosomes) - Actinopodes ( <i>Amoeba</i> ) - Sporozoans ( <i>Plasmodia</i> ) - Cnidosporia ( <i>Myxobolus</i> ) - Ciliata ( <i>Paramecium</i> )	
89. Describe habitat of paramecium.	<b>4.3. Example: <i>Paramecium</i></b> Habitat	- Guided by the teacher, students set up hay infusion for

<p>90. Explain external and internal organisation of a <i>paramecium</i>.</p>	<p>External and internal organisation</p>	<p><i>Paramecium</i> culture.</p>
<p>91. Explain physiological functioning of a <i>paramecium</i></p>	<p>Physiology : locomotion, nutrition, respiration, circulation, excretion, reproduction</p>	<p>- Microscopic observation of living paramecium. - Use prepared slides, charts, photos...</p>
<p>92. Explain economic importance of protoctista</p>	<p>4.4. Economic importance of protoctista</p>	
<p>93. State general characteristics of prokaryotes.</p>	<p><b>CHAPTER 5.</b></p>	
<p>94. Describe a generalized structure of bacteria.</p>	<p><b>PROKARYOTE KINGDOM/ MONERA</b></p>	
	<p>5.1. General characteristics</p>	
	<p>5.2. Description of the structure of bacteria</p>	

<p>95. Give a simple classification of bacteria</p>	<p>5.3. Simple classification:</p> <p>a. ARCHAEBACTERIA:</p> <ul style="list-style-type: none"> <li>- Methanogens bacteria: methane producing bacteria. Ex.: <i>Methanosarcina</i>, <i>Methanothermobacter</i></li> <li>- Halophiles bacteria: salt-loving species. Ex.: <i>Halobacterium</i></li> <li>- Thermoacidophiles bacteria: tolerant of extreme heat and acidity. Ex.: <i>Sulfolobus</i></li> </ul> <p>b. EUBACTERIA</p> <p>Gram positive (+):</p> <ul style="list-style-type: none"> <li>- Actinomycetes: cell wall present; filamentous soil and water bacteria</li> </ul> <p>Ex.: <i>Streptomyces</i></p> <ul style="list-style-type: none"> <li>- rods and cocci: pathogen and industrial bacteria, cell wall present. Ex.: <i>Staphylococcus</i>, <i>Lactobacillus</i></li> </ul> <p>Gram negative (-):</p> <ul style="list-style-type: none"> <li>- Non-photosynthetic bacteria: cell wall present; medicinal, industrial and</li> </ul>	<ul style="list-style-type: none"> <li>- Microscopic observation of prepared slides; draw and label the structure of bacteria</li> <li>- Use charts</li> </ul>
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	<p>environmental importance. Examples:</p> <ul style="list-style-type: none"> <li>➤ Chemoautotrophic bacteria: <i>Nitrosomonas</i></li> <li>➤ Soil bacteria: <i>Agrobacterium</i></li> <li>➤ Spirochaetes: <i>Treponema</i></li> <li>➤ Pathogenic bacteria: <i>Escherichia</i></li> </ul> <p>- Anaerobic synthetic bacteria: cell wall present; green and purple sulphur and non-sulphur bacteria</p> <p>- Mycoplasmas: cell wall absent, intracellular parasites Ex.: <i>Mycoplasma pneumoniae</i>, <i>Rickettsia</i></p>	
<p>96. State economic importance of bacteria</p>	<p><b>5.5. Economic importance</b></p> <p><b>CHAPTER 6. ANIMAL KINGDOM</b></p>	
<p>97. State main divisions of animal kingdom</p>	<p><b>6.1. Major groups of animal kingdom</b></p> <ul style="list-style-type: none"> <li>➤ Chordata :</li> </ul> <p>- Vertebrate (with spinal chord)</p>	<p>- Students observe specimens, videos, photographs, charts and drawings</p>

<p>according to the absence / presence of the spinal chord and the notochord</p> <p>98. State economic importance of Chordata and non chordate invertebrates</p> <p>99. Identify general characteristics of non chordate Invertebrates</p> <p>100. Describe general characteristics of <i>Hydra</i> and its habitat</p> <p>101. Explain internal and external organization of</p>	<p>- Chordate Invertebrate (with notochord) ➤ Non chordate Invertebrate</p> <p>Economic importance of Chordata Economic importance of non chordate invertebrate</p> <p><b>6.2. Non chordate Invertebrate</b> 6.2.1. General characteristics 6.2.2. Example: <i>Hydra</i> General characteristics and habitat</p> <p>Internal and external organization</p>	
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<p><i>Hydra</i></p> <p>102. Explain physiological functioning of <i>Hydra</i></p> <p>103. State economic importance of <i>Hydra</i></p> <p>104. Classify non chordate invertebrate into phyla with example</p>	<p>Physiology : locomotion, nutrition, respiration, circulation, excretion, reproduction</p> <p>Economic importance</p> <p>6.2.3. Classification</p> <ul style="list-style-type: none"> <li>* Phylum: - Porifera (eg. Sponges)</li> <li>* Phylum: - Coelenterata (eg. Hydra)</li> <li>* Phylum: - Platyhelminthes (eg. Tapeworm)</li> <li>* Phylum: - Nematoda (eg Roundworm)</li> <li>* Phylum: - Annelida (e.g. Earthworm, leech)</li> <li>* Phylum: - Echinodermata ( eg Starfish, sea urchin)</li> <li>* Phylum: - Mollusca (eg. Garden snails)</li> <li>* Phylum: - Arthropoda (eg. Bee)</li> </ul>	<ul style="list-style-type: none"> <li>- Guided by the teachers, students collect specimens of Arthropoda and group them into classes</li> <li>- Students observe the characteristics of bees and ants and draw the mouth parts</li> </ul>
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<p>105. Classify phylum Arthropoda into classes and distinguish them.</p> <p>106. Classify insects into orders according to the features of the wings and mouth parts</p> <p>107. Describe characteristics of bees(hymenoptera) and ants (Isoptera)</p> <p>108. Identify general characteristics of chordata</p> <p>109. State differential characteristics of the chordata</p>	<p>Classes of Arthropoda and differences</p> <p>Classification of insects into orders according to the features of their wings and mouth parts.</p> <p>Characteristics of bees Characteristics of ants</p> <p><b>6.3. Chordata</b> 6.3.1. general characteristics of chordata differential characteristics of chordata</p>	
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<p>110. Classify Chordata into classes and name importance of each</p>	<p>6.3.2. Principal classes of Chordata and importance</p> <ul style="list-style-type: none"> <li>- Fishes</li> <li>- Amphibians</li> <li>- Reptiles</li> <li>- Birds</li> <li>- Mammals</li> </ul>	<p>Field trips in National parks(Akagera, Birunga &amp; Nyungwe national park)</p>
<p>111. Classify mammals into subclasses</p>	<p>6.3.3.Classification of mammals into subclasses</p> <ul style="list-style-type: none"> <li>- Monotrema</li> <li>- Marsupians</li> <li>- Eutheria</li> </ul>	<p>- Guided by the teachers, students summarize in a synthetic table the characteristics of chordata</p>
<p>112. Classify Eutheria into orders with example and importance</p>	<p>Classification of Eutheria and importance</p> <p>Rodentia eg. Rabbit</p> <p>Carnivora eg.dog</p> <p>Ungulata eg.cow</p> <p>Insectivora eg. Anthog</p> <p>Chiroptera eg. Bat</p>	
<p>113. Describe habitat and mode of life of a given</p>	<p>Cetacea eg. Whale</p> <p>Primata eg. Gorilla, man</p> <p>description: habitat, organisation, mode of</p>	

mammal.  114. Compare characteristics of different classes of Chordata	life differential characteristics and similarities of classes Chordata	
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**Summary table of distribution of chapters /content and periods allocation per term in form four**

<b>Term</b>	<b>Content</b>		<b>Periods</b>
<b>First term</b>	Chapter 1: Classification of living organisms		9
	Chapter 2: Plant kingdom	Root	4
		Stem	4
		Leaf	4
		Sexual organs	5
		Sexual reproduction of flowering	5
		Fruits and seeds	5
Dispersal and germination	5		

		Asexual reproduction	5
		Classification of flowering plants:	10
		Classification of Non flowering plants:	7
		a. Bryophytes	7
		<b>TOTAL</b>	<b>70</b>
<b>Second term</b>	Chapter 2 Plant kingdom (cont)	b. Phycophytes (Algae)	8
		c. Lichens	7
	Chapter 3: Kingdom Fungi	Microscopic Fungi	18
		Macroscopic Fungi	12
	Chapter 4: Kingdom Protocista		18
	Chapter 5: Kingdom Monera		7
<b>TOTAL</b>		<b>70</b>	
<b>Third term</b>	Chapter 6: Animal Kingdom	General characteristics of Non chordate	3
		Phylum: Porifera	3
	1. Non Chordate Invertebrate	Phylum: Coelenterata	3
		Phylum Platyhelminths	6
		Phylum: Nematoda	6
		Phylum: Annelida	6
		Phylum: Echinodermata	3
		Phylum: Mollusca	3
		Phylum: Arthropoda	9

	2. Chordata	General characteristics and classification	9
		Classification of mammals	14
		Comparison of Chordata groups	5
	<b>TOTAL</b>		<b>70</b>
<b>Total number of periods in form four</b>			<b>210</b>

# **BIOLOGY CURRICULUM FROM FIVE (PRINCIPAL SUBJECT)**

**7 Periods / week**

## **GENERAL OBJECTIVES**

At the end of form five, learners will be able to:

1. State and explain chemical components of life and explain their functions
2. Explain structure of plant and animal cell and the functions of the cell organelles
3. Describe plant and animal tissues and explain their functions
4. Explain importance of micro-organisms and suggest preventive measures and how to fight against harmful ones
5. Describe structural and functional adaptations of plants to their environment.

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENTS : TOPIC/SUB-TOPICS</b>	<b>METHODOLOGY NOTES</b>
<p>At the end of the chapter, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Explain physical and chemical properties of water.</li> <li>2. Explain physiological functions of water.</li> </ol>	<p><b>CHAPTER I.</b>  <b>CHEMICALS OF LIFE</b></p> <p><b>1.1. Water</b></p> <p>1.1.1. Physical and chemical properties of water:</p> <ul style="list-style-type: none"> <li>- Hydrogen bond</li> <li>- High boiling point</li> <li>- Density</li> </ul> <p>1.1.2. Physiological functions</p> <ul style="list-style-type: none"> <li>- Thermal regulator</li> <li>- Reactant</li> <li>- Medium of life</li> </ul>	<ul style="list-style-type: none"> <li>- Students discuss about the physical and chemical properties of water in the three states of matter</li> <li>- Experiments on the physical properties of water</li> <li>- Teacher-student discussion about physiological functions of water.</li> </ul>

<p>3. State different sources of mineral salts</p> <p>4. State essential minerals in living organisms</p>	<p><b>1.2. Mineral salts</b></p> <p>1.2.1. Sources of mineral salts</p> <p>1.2.2. Essential minerals (Na<sup>+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Cu<sup>2+</sup>, Fe<sup>2+</sup>/ Fe<sup>3+</sup>, I<sup>-</sup>, Cl<sup>-</sup>, BO<sub>3</sub><sup>3-</sup>, NO<sub>3</sub><sup>-</sup> / NO<sub>2</sub>, SO<sub>4</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup> ...)</p>	<p>- Students discuss different types of mineral salts</p>
<p>5. State role of mineral elements in living organisms.</p> <p>6. Identify common mineral salts deficiency symptoms in living organisms.</p>	<p>1.2.3. Roles of mineral salts</p> <p>1.2.4. Effects of mineral salts deficiency</p>	<p>- Students observe and compare healthy plants and plants with common deficiency symptoms.</p> <p>- Use charts, photographs and videos</p> <p>- Visit nursery beds</p>
<p>7. Give types of lipids and their sources</p>	<p><b>1.3. Lipids</b></p> <p>1.3.1. Types of lipids &amp; source</p>	<p>- Carry out an experiment on the emulsion test using ethanol, using Sudan III or a white</p>



<p>8. Draw a simple structure of lipids.</p> <p>9. State role of lipids in living organisms.</p> <p>10. Carry out a test for lipids in living organisms</p> <p>11. Enumerate sources of proteins</p> <p>12. Explain general structure of amino acids.</p> <p>13. Distinguish between essential and non essential amino acids.</p> <p>14. Explain formation of peptide bonds</p>	<p>1.3.2. Structure of lipids</p> <p>1.3.3. Role of lipids</p> <p>1.3.4. Test for lipids (<b>fats and oils</b>)</p> <p><b>1.4. Proteins</b></p> <p>1.4.1. Sources of proteins.</p> <p>1.4.2. General structure of amino acids</p> <p>1.4.3. Essential and non essential amino acids</p> <p>1.4.4. Formation of peptide bond</p> <p>1.4.5. Fibrous and globular proteins</p> <p>1.4.6. Structures of proteins</p>	<p>paper on different food stuffs (e.g. Avocado, ground nuts, milk, vegetable oil, etc</p>
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<p>15. State functions of proteins</p> <p>16. Carry out a test for proteins using Biuret test.</p> <p>17. State sources of carbohydrates.</p> <p>18. Enumerate main types of monosaccharides</p> <p>19. Distinguish between monosaccharides, disaccharides and polysaccharides.</p>	<p>(Brief description)</p> <p>1.4.7. Functions of proteins</p> <p>1.4.8. Test for proteins (Biuret Test)</p> <p><b>1.5. Carbohydrates</b></p> <p>1.5.1. Source of carbohydrates</p> <p>1.5.2. Structure and isomerism of monosaccharides (glucose, fructose, galactose, ribose, deoxyribose, ribulose)</p> <p>1.5.3. Classification of carbohydrates: monosaccharides, disaccharides (maltose, sucrose, lactose) and</p>	<p>- Conduct Biuret test or Millon's test for proteins using protein containing food substrates eg. Milk, egg.etc.</p> <p>Guided by a teacher, students will collect food stuffs and identify carbohydrates</p>
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<p>20. Give structure of glucose, ribose, and deoxyribose</p> <p>21. Discuss function of carbohydrates</p> <p>22. Carry out a confirmatory test on the presence of reducing sugars, non reducing sugars and starch.</p> <p>23. Define word vitamins and classify the vitamins into groups</p> <p>24. Give sources and functions of vitamins.</p>	<p>polysaccharides (starch, glycogen, cellulose)</p> <p>1.5.4. Function of Carbohydrates</p> <p>1.5.5. Tests for reducing sugars, non reducing sugar and starch</p> <p><b>1.6. Vitamins</b></p> <p>Definition</p> <p>Classification (fat soluble and water soluble vitamins).</p> <p>Sources of vitamins</p>	<p>- Students carry out confirmatory tests for reducing, non reducing sugars and starch. (using Benedict's solution and Iodine solution)</p> <p>Carry out test for vitamin C using DCPIP (Dichlorophenol-Indophenol) and food stuffs (e.g. citrus fruits, green vegetables, potatoes and tomatoes)</p>
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25. Carry out a test for the presence of vitamin C	Functions of vitamins Test for vitamins	- Use charts, videos
26. Draw structure of a nucleotide	<b>1.7. Nucleic Acids</b> 1.7.1. Structure of nucleotide ( pentose, base, and phosphate)	- Use models, charts
27. State types of DNA and RNA, their structure and their function	1.7.2. DNA - Types - Structure - Function 1.7.3. RNA. - Types - Structure - Function	
28. Explain DNA replication.	DNA replication	
29. Give differences and similarities of DNA and RNA.	Comparison between DNA and RNA	-Use charts to show the mode of action of enzymes.

<p>30. Give definition of enzymes and explain enzyme nomenclature.</p> <p>30. State properties of enzymes and explain their mode of action</p> <p>31. Explain enzymes inhibition effect</p> <p>32. Explain co-factors theory</p> <p>33. Explain effect of factors affecting enzyme activities.</p>	<p><b>1.8. Enzymes;</b></p> <p>1.8.1. Definition</p> <p>1.8.2. Nomenclature</p> <p>1.8.3. Properties of enzymes &amp; mode of action</p> <p>1.8.4. Inhibitors of enzymes</p> <p>1.8.5. Co-factors: prosthetic, coenzymes, inorganic ions</p> <p>1.8.6. Factors affecting enzyme activities : pH, concentration (enzyme, substrate), temperature and inhibitors</p>	<p>- Use saliva, amylase powder and starch at different temperature to illustrate the effect of temperature on enzyme action.</p>
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<p>34. Define cytology and cell.</p> <p>35. Explain briefly the cell theory.</p> <p>36. Draw and label an ultra structure of a cell.</p> <p>37. Explain structure and the role of each cell organelle</p> <p>38. Distinguish between plant and animal cells</p> <p>39. Distinguish between prokaryote and eukaryote cells</p> <p>40. Explain mechanism of transport of</p>	<p><b>CHAPTER 2.</b> <b>CYTOLOGY</b></p> <p><b>2.1. Definitions of</b> Cell, Cytology</p> <p><b>2.2. Cell theory</b></p> <p><b>2.3. Cell's ultra structure</b> Structure and functions of cell's organelles</p> <p>Plant cell and animal cell</p> <p>Prokaryote and eukaryote cell</p> <p><b>2.4. Membrane permeability</b></p> <p>- Mechanism of transport of substances across the</p>	<p>- Use charts, models, photographs to compare cells.</p> <p>- Using a microscope and prepared slides compare plant and animal cells.</p> <p>- Conduct experiments to illustrate the transport of</p>
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<p>substances across the cell membrane</p> <p>41. Define water potential of a cell</p> <p>42. Calculate water potential</p> <p>43. Define genetic code and state its characteristics</p> <p>44. Describe protein biosynthesis.</p>	<p>cell membrane</p> <ul style="list-style-type: none"> <li>. Active transport (pinocytosis, phagocytosis, endocytosis and exocytosis )</li> <li>. Passive transport ( Osmosis and Diffusion,)</li> </ul> <p>Water potential</p> <p>Calculation of water potential</p> <p><b>2.5 Genetic code and protein synthesis</b></p> <p><b>2.6. Cell division</b></p>	<p>substances across the cell membrane (plasmolysis, turgidity, osmosis and diffusion).</p> <p>By applying the formula <math>\psi_{\text{cell}} = \psi_p + \psi_s</math> , learners will calculate the water potential of a cell</p> <p>Use charts to observe biosynthesis of proteins</p>
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45. Locate and describe structure changes of chromosomes during mitosis and meiosis.	Location and structure changes of chromosomes during the cell division Amitosis (binary division), Mitosis, Meiosis	
46. Explain stages and role of cell division	Stages of cell division Role of cell division Comparison of mitosis and meiosis	
47. Compare mitosis and meiosis	Cell differentiation	
48. Explain cell differentiation		
	<p><b>CHAPTER 3.</b> <b>HISTOLOGY</b> <b>3.1. Plant histology and Anatomy</b> <b>3.1.1. Histology</b></p>	
49. Define concepts: tissue, meristem, histology and anatomy	<b>3.1.1.1. Definitions:</b> tissue, meristem, histology, anatomy	<ul style="list-style-type: none"> <li>- Observe slides of plant tissues under microscope and draw</li> <li>- Use charts and photographs.</li> </ul>



<p>50. Locate and describe structure of meristems</p>	<p><b>3.1.1.2.</b> Structure and localisation of meristems  3.1.1.3. Meristems  Apical meristems and role  Lateral meristems and role</p>	<p>- Students observe and draw protective tissues</p>
<p>51. Differentiate apical and lateral meristems and state their role</p>	<p>Difference between apical and lateral meristems</p>	
<p>52. Draw and label structure of protective tissues</p>	<p><b>3.1.1.4.</b> Protective tissues :  - Epidermis  - Cork cells</p>	
<p>53. Explain functioning and the role of root hairs</p>	<p><b>3.1.1.5.</b> Root hairs functioning and role of root hairs</p>	
<p>54. Differentiate different types of parenchyma by using drawings</p>	<p><b>3.1.1.6.</b> Parenchymatous tissues:</p>	
<p>55. Identify conducting tissues, state their main characteristics</p>	<p><b>3.1.1.7.</b> Conducting tissues:  - Xylem  - Vessels</p>	<p>- Microscopic observations of different types of conducting tissues and draw</p>

<p>and explain their roles</p> <p>56. Describe, draw and label sclerenchyma and collenchyma tissues</p> <p>57. Distinguish between sclerenchyma and collenchymas</p> <p>58. State functions of sclerenchyma and collenchyma.</p>	<ul style="list-style-type: none"> <li>- Tracheids</li> <li>- Phloem</li> <li>- Sieve tubes</li> <li>- Companion cells</li> </ul> <p><b>3.1.1.8. Supporting tissues:</b> (Sclerenchyma, collenchyma) Characteristics Structures Difference between the sclerenchyma and the collenchyma</p> <p>Functions</p>	<ul style="list-style-type: none"> <li>- Microscopic observation supporting tissues slides and draw</li> </ul>
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<p>59. Locate, describe and differentiate Secretory tissues.</p>	<p><b>3.1.1.9. Secretory tissues:</b>          Localisation          Secretory hairs          Secretory sacs          Secretory canals          Latex secreting cells</p> <p><b>3.1.2. Anatomy</b>  <b>3.1.2.1. Root</b></p>	<p>- Microscopic observation of prepared slides (both temporary and permanent slides) of different tissues.</p>
<p>60. Describe internal structure of monocotyledonous and dicotyledonous root</p>	<p>Internal structure of a monocotyledonous root</p>	<p>- Microscopic slides observation and draw</p>
<p>61. Differentiate internal structure of a monocotyledonous root from a dicotyledonous root</p>	<p>Internal structure of a dicotyledonous root          Difference between the internal structure of a monocotyledonous root and the internal structure of a dicotyledonous root</p>	

<p>62. Describe internal structure of a monocotyledonous and dicotyledonous stem</p>	<p><b>3.1.2.2. Stem</b> Internal structure of a monocotyledonous stem Internal structure of a dicotyledonous stem</p>	<p>- Microscopic slides observation and draw</p>
<p>63. Differentiate internal structure of a monocotyledonous stem from a dicotyledonous stem</p>	<p>Difference between the internal structure of monocotyledonous stem and the internal structure of a dicotyledonous stem</p>	
<p>64. Describe internal structure of a monocotyledonous and dicotyledonous leaf</p>	<p><b>3.1.2.3. Leaf</b> Internal structure of a monocotyledonous leaf Internal structure of a monocotyledonous leaf</p>	<p>- Microscopic slides observation and draw</p>
<p>65. Describe structure of a stomata and state its role</p>	<p>Structure (drawing) of a stomata</p>	

<p>66. Differentiate internal structure of a monocotyledonous leaf from a dicotyledonous leaf</p>	<p>Role of a stomata Difference between the internal structure of a monocotyledonous leaf and a dicotyledonous leaf</p>	
<p>67. Locate and describe various types of animal tissues by using drawings</p>	<p><b>3.2. Animal histology</b> <b>Main animal tissues:</b> Epithelial, connective, muscular, nervous and skeletal tissues</p>	<p>- Microscopic slides of different animal tissues observation and diagram</p>
<p>68. Explain role of the main animal tissues</p>	<p><i>For each type give: the location, description and the role</i></p>	
<p>69. Define microbiology and classify microbes according to their morphology</p>	<p><b>CHAPTER 4.</b> <b>MICROBIOLOGY AND HYGIENE</b> 4.1. Microbiology 4.1.1 Definition of microbiology.</p>	<p>- Observation and diagram of micro-organisms under microscope - Use photographs, charts</p>

<p>70. Describe principles of micro-organisms culture techniques</p> <p>71. Explain physiological functioning in micro-organisms.</p> <p>72. Describe life cycle of different types of micro-organisms.</p>	<p>4.1.2. General classification of micro-organisms :</p> <ol style="list-style-type: none"> <li>1. Viruses</li> <li>2. Bacteria</li> <li>3. Protozoans</li> <li>4. Moulds</li> <li>5. Cyanobacteria</li> </ol> <p><b>4.1.3. Principles of micro-organisms culture techniques:</b>  Medium of culture  Culture techniques  Growth curves</p> <p><b>4.1.4. Physiology of micro-organisms:</b>  nutrition, respiration</p> <p>Life cycles of micro-organisms</p>	
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<p>73. Explain the mechanism of toxin secretion.</p> <p>74. Explain effect of external environment on life of micro-Organisms</p> <p>75. Explain role of micro-organisms in fermentation process</p> <p>76. Describe types of fermentation</p> <p>77. Explain role of micro-organisms in food conservation, brewing, tanning, water sterilisation and purification</p>	<p>Mechanisms of toxin secretion by micro-organism</p> <p>Effect of the environment on micro- organisms</p> <p>Role of micro-organisms in fermentation process</p> <p>Description of types of fermentation</p> <p><b>4.1.5. Applications of microbiology.</b></p> <p>Food conservation</p> <p>Brewing</p> <p>Tanning</p> <p>Water sterilisation and purification</p> <p>Vaccination and immunization</p>	<p>Experiments and practical work: Visit industries which apply microbiology (e.g. Inyange, Nyabisindu etc )</p>
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<p>78. Identify infectious diseases and organism's defensive mechanism</p> <p>79. Describe mode of transmission and prevention of HIV/AIDS</p> <p>80. Describe organism's defensive mechanism</p> <p>81. Define antibodies and antigens</p>	<p><b>4.2. Hygiene</b>  <b>4.2.1. Infectious diseases</b>  (viral, bacterial, fungal, diseases due to some protozoans)</p> <p>➤ HIV/AIDS  Mode of transmission  Prevention of HIV/AIDS</p> <p><b>4.2.2. Organism's defensive mechanism against micro- organisms:</b>  natural and acquired immunity</p> <p>Antibody:  Antigen:</p>	<p>Through a discussion show the modes of transmission and prevention of infectious diseases.</p>
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<p>82. Explain artificial ways of fighting micro-organisms</p> <p>83. Give examples of antibiotics and their utilization</p> <p>84. Explain drug resistance and state its causes</p> <p>85. Identify and describe features of worm infections and state how to fight against them</p> <p>86. Identify and state features of deficiency diseases</p>	<p><b>4.2.3. Artificial ways of fighting against micro-organisms</b> (asepsis, antisepsis, vaccination, serotherapy, chemotherapy, antibiotics) Examples of antibiotics and utilization</p> <p>Drug resistance of micro-organisms and causes</p> <p><b>4.2.4. Worm infections</b> without intermediate host: with intermediate host:</p> <p><b>4.2.5. Deficiency diseases</b> . Kwashiorkor . Marasmus . Vitamin deficiency diseases</p>	<p>- Deduce prevention of worm infection from the life cycle of worms</p>
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<p>87. Describe water and sieve transport in plants.</p> <p>88. Enumerate factors affecting transpiration</p> <p>89. Explain adaptation of plants to avoid water loss</p> <p>90. State the importance of transpiration</p>	<p><b>CHAPTER 5.</b> <b>PLANT PHYSIOLOGY</b></p> <p><b>5.1. TRANSPORT IN PLANTS</b></p> <p>Water transport</p> <ul style="list-style-type: none"> <li>- Absorption of water</li> <li>- Transpiration</li> </ul> <p>Mineral salts transport</p> <p>Organic matter transport (translocation)</p> <p>Factors affecting transpiration</p> <p>Plants adaptation to avoid water loss</p> <p>Importance of transpiration</p>	<ul style="list-style-type: none"> <li>- Use charts and diagrams</li> <li>- Use of a potted plant rapped with polythene bag to demonstrate transpiration</li> <li>- Use potometer to show water up take by plants</li> <li>- Discuss ringing experiments to illustrate translocation (where possible carry out these experiments)</li> <li>- Use model to show mass flow hypothesis</li> </ul>
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<p>91. Explain usefulness of photosynthesis</p> <p>92. Describe the adaptations of leaves for photosynthesis</p> <p>93. Describe the light and chemical processes involved in photosynthesis</p> <p>94. Differentiate between C<sub>3</sub> and C<sub>4</sub> plants</p> <p>95. State the conditions and the importance of photosynthesis</p> <p>96. State criteria for measuring growth of plants</p>	<p><b>5.2. Photosynthesis (Autotrophic nutrition)</b></p> <ul style="list-style-type: none"> <li>- Importance</li> <li>- Structure of leaf</li> <li>- Chloroplast and photosystems</li> <li>- Photosynthetic pigments</li> <li>- Biochemistry of photosynthesis (photochemical reactions, cyclic reactions)</li> <li>- C<sub>3</sub> and C<sub>4</sub> plants</li> <li>- Factors affecting photosynthesis</li> <li>- Photorespiration</li> <li>- chemosynthesis</li> </ul> <p><b>5.4. Plant growth</b></p> <ul style="list-style-type: none"> <li>- Measure of plant growth</li> <li>- Plant hormones</li> </ul>	<p>Simple experiments should be carried out to show the effects of light intensity, concentration of CO<sub>2</sub> and the temperature.</p> <p>Simple means of measuring rate of photosynthesis. E.g. oxygen production in water plants and starch production in terrestrial plants.</p> <p>Observe a bean seedling within a week to measure its growth.</p>
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<p>97. State main plant hormones and their role</p>	<p>- Main plant hormones (Auxins, gibberellins, cytokinins, abscisic acids, ethene) and their roles</p>	
<p>98. Explain factors affecting the distribution of plant hormones.</p>	<p>- Factors affecting their distribution and influence on plant growth.</p>	<p>- Use a potted plant in cardboard with a hole on one side to illustrate the effect of phototropism</p>
<p>99. Define tropism and explain the different types of tropism</p>	<p>- Tropisms: Phototropism, Geotropism, Hydrotropism, Thigmotropism, Chemotropism</p>	<p>- Use a clinostat to illustrate the effect of gravity and light on plant shoots</p>

**Summary table of distribution of chapters / content and period allocation per term in form five**

<b>TERM</b>	<b>CONTENT</b>		<b>PERIODS</b>
Term 1	Chapter 1: Chemicals of life (Biological molecules)	1. Water	5
		2. Mineral salts and lipids	7
		3. Proteins	5
		4. Carbohydrates and vitamins	7
		5. Nucleic acids	5
		6. Enzymes	5
	Chapter 2: cytology	1. Definitions, cell theory & ultrastructure of a cell	7
		2. Membrane permeability	9
		3. Genetic code and proteins synthesis	7
		4. Cell division	13
<b>TOTAL</b>		<b>70</b>	
Term 2	Chapter 3: histology	1. Plant Histology and Anatomy	35
		2. Animal Histology	35
	<b>TOTAL</b>	<b>70</b>	
	Chapter 4: Microbiology and Hygiene	Classification and principles of micro organisms culture	7

Term 3	❖ Microbiology ❖ Hygiene	Physiology of micro organisms	13
		Application of microbiology	7
		Infectious diseases	<b>5</b>
		Immunity system and artificial ways of fighting against micro- organisms	5
		Worm infections and deficiency diseases	5
	Chapter 5: Plant Physiology	Transport in plants	9
		Autotrophic Nutrition	12
		Plant Growth	7
		<b>TOTAL</b>	<b>70</b>
<b>TOTAL NUMBER OF PERIODS IN FORM FIVE</b>		<b>210</b>	

# **BIOLOGY CURRICULUM FORM SIX**

## **(PRINCIPLE SUBJECT)**

7 Periods / week

### **GENERAL OBJECTIVES**

At the end of form six, learners will be able to:

1. Explain and compare modes of action of nervous and endocrine systems.
2. Describe mechanisms of homeostasis
3. Describe structure of human reproductive system and explain process of Gametogenesis
4. Explain role of chromosomes in transmission of hereditary characteristic and diseases
5. Explain scientific theories of evolution of species
6. Establish relationship between anatomic structure of animals and adaptation of types of movements to the environment.
7. Explain complex relationship existing between living organisms within their environment

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENTS:TOPICS / SUB - TOPICS</b>	<b>METHODOLOGY NOTES</b>
<p>At the end of the chapter , learners will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify components of nervous system</li> <li>2. Locate brain and spinal cord and explain their role</li> <li>3. Explain nerve physiology</li> <li>4. Explain electrical phenomena of nervous function</li> </ol>	<p><b>CHAPTER 1. ANIMAL PHYSIOLOGY</b>  <b>1.1.COORDINATION</b>  <b>1.1.1. Nervous system and sense organs.</b></p> <p>1.1.1.1.The nervous system</p> <ul style="list-style-type: none"> <li>-Components of the nervous system</li> <li>• Central nervous system</li> <li>• Peripheral nervous system</li> </ul> <p>-Location of the brain and the spinal chord</p> <p>Role of the brain</p> <p>Role of the spinal chord</p> <p>Nerve physiology</p> <ul style="list-style-type: none"> <li>- Nerve excitability</li> <li>- Action and Resting potentials</li> <li>- Conduction along the nerve.</li> <li>- Conduction across synapses</li> </ul>	<ul style="list-style-type: none"> <li>- Use charts microfilms and videos.</li> <li>- Dissection of the nervous system of a rabbit, rat, frog, fish, etc.</li> </ul>



<p>5. Explain role and mode of action of neurotransmitters in the physiology of nerves</p> <p>6. State sense organs and their role</p> <p>7. Draw and label structures of sense organs.</p> <p>8. Explain functioning mechanism of each sense organ.</p> <p>9. Define a gland and state types of glands</p> <p>10. Define a hormone and give history of hormone's discovery</p>	<p>- Neurotransmitters Electrical phenomena of the nervous function Role of neurotransmitters Mode of action of neurotransmitters Health practices of nervous system</p> <p>1.1.1.2.Sense organs and role</p> <p>Ear, Eye, Tongue, Skin, Nose Structure of sense organs</p> <p>Functioning mechanism of sense organs</p> <p><b>1.1.2. Endocrinology</b> -Gland: Types of Glands -Hormone : Historical background of their discovery</p>	<p>Discussion on health practices</p> <p>- Guided discussion about effects of some hormones (e.g. sexual hormones during puberty)</p>
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<p>11. List and locate principal endocrine glands</p> <p>12. Briefly describe action of hormones on their target organs</p> <p>13. Identify relationship between the nervous and endocrine systems</p> <p>14. Differentiate nervous system from endocrine system and explain how one controls the other</p> <p>15. Define: internal environment and homeostasis</p> <p>16. Describe formation of the interstitial fluid.</p> <p>17. Explain mechanism of internal environment regulation.</p> <p>18. State excretory organs and their waste products.</p>	<p>Endocrine glands :</p> <p>Location of endocrine glands:</p> <p>Action of hormones on target organs</p> <p>Relationship between nervous and endocrine systems</p> <p>Difference between nervous and endocrine system.</p> <p><b>1.2. HOMEOSTASIS</b></p> <p><b>1.2.1. Internal environment:</b></p> <p>Homeostasis</p> <p>Internal environment.</p> <p>Formation of the interstitial fluid</p> <p>Mechanism of regulation</p> <p><b>1.2.2. Excretion</b></p> <p>Excretory organs and their waste products (skin, kidney, lungs, liver,</p>	<p>- Guided discussions about the ways by which body reacts to balance its internal environment (e.g. after a salty meal)</p>
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<p>19. State nitrogenous waste products of different animals.</p> <p>20. Define glycaemia and state role of hormones in regulation of glycaemia</p> <p>21. Explain effects of hypoglycaemia and hyperglycaemia on the human physiology</p> <p>22. State types of diabetes, their cause and control measures</p> <p>23. Draw and label structure of a kidney and nephron.</p> <p>24. Explain role of kidneys in regulation of internal medium (environment)</p>	<p>Malpighian tubules, nephridia)</p> <p>Nitrogenous waste products</p> <p>NH<sub>3</sub> : Example: Fish</p> <p>Trimethyl amine oxide: Example: fish</p> <p>Urea: example: mammals</p> <p>Uric acid: Example: reptiles, birds and insects</p> <p><b>1.2.3. Blood glucose level regulation:</b></p> <p>Glycaemia</p> <p>Role of pancreas</p> <p>Role of liver</p> <p>Hypoglycaemia effects</p> <p>Hyperglycaemia effects</p> <p>Types of Diabetes.</p> <p>Causes</p> <p>Preventive and curative measures</p> <p><b>1.2.4. Osmoregulation:</b></p> <p>Anatomy of the kidney and nephron</p> <p>Role of kidneys in the regulation of internal medium</p>	<p>Use a glucometer to measure glycaemia.</p> <p>- Use charts</p>
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<p>25. Explain role of the nephron in urine formation.</p> <p>26. Give both chemical and biological components of blood plasma.</p> <p>27. Compare blood plasma and urine in relation to their composition</p> <p>28. State some causes of kidney failure.</p> <p>29. State ways by which the body loses or gains heat.</p> <p>30. Explain control of body temperature in both endotherms and ectotherms organisms</p> <p>31. Explain role of hypothalamus in body temperature control</p>	<p>Role of nephron in urine formation</p> <p>Chemical and biological components of blood plasma</p> <p>Comparison of blood plasma and urine</p> <p>Causes of kidney failure</p> <p><b>1.2.5. Thermoregulation;</b> Loss and gain of heat Endotherms Ectotherms</p> <p>Role of hypothalamus in thermoregulation.</p>	<p>- Through teacher guided discussion, learners discuss how the body regulates temperature in various weather conditions.</p>
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<p>32. State chemical buffers of the body</p> <p>33. Explain role of respiratory gases in acid-base balance.</p> <p>34. Explain role of kidneys in (pH) acid-base balance.</p> <p>35. Explain adaptations of animals in climatic conditions</p> <p>36. State and describe structure of respiratory organs in different groups of animals.</p> <p>37. Explain breathing mechanism in animals.</p>	<p><b>1.2.6. Acid - base balance (pH).</b> Chemical buffers of the body</p> <p>Regulation of respiratory gases</p> <p>Kidneys' role in acid-base balance.</p> <p><b>1.2.7. Some adaptations for homeostasis</b> Case study of camel Case study of Kangaroo rat.</p> <p><b>1.3. RESPIRATION AND GASEOUS EXCHANGE IN ANIMALS:</b> <b>1.3.1. Gaseous exchange in:</b> Micro-organisms Insects Fishes Mammals</p>	<p>Use of video and photographs.</p> <p>- Use charts - Dissect a mammal and a fish and observe the respiratory organs - Use charts - Dissect a mammal and a fish and observe the respiratory</p>
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<p>38. Define respiration and describe gaseous exchange in animals</p> <p>39. State types of respiration</p> <p>40. Explain stages of aerobic respiration</p> <p>41. Discuss energy balance of the aerobic respiration</p> <p>42. Explain respiratory quotient</p> <p>43. Explain need for a transport system in animals.</p>	<p><b>1.3.2. Mechanism of ventilation;</b> Physical process Chemical process</p> <p><b>1.3.3. Respiration</b></p> <p>Types of respiration - Aerobic - Anaerobic</p> <p>Stages of aerobic respiration: glycolysis, Kreb's cycle and electron transport pathway</p> <p>Energy balance of aerobic respiration</p> <p>Respiratory quotient</p> <p><b>1.4. TRANSPORT IN ANIMALS:</b> <b>1.4.1. Need for transport system</b></p>	<p>organs</p> <ul style="list-style-type: none"> <li>- Use diagrams and charts</li> <li>- conduct experiments to show that :</li> <li>• carbon dioxide is produced during respiration</li> <li>• oxygen is necessary for respiration</li> </ul>
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<p>44. State components of blood.</p> <p>45. State and explain functions of blood.</p> <p>46. Define blood circulation</p> <p>47. Describe and explain structure and the functioning of human heart</p> <p>48. Describe types of blood circulation.</p> <p>49. Differentiate systemic circulation and pulmonary circulation</p> <p>50. State some disorders of circulatory system.</p>	<p><b>1.4.2. Blood components</b></p> <p>Blood functions (e.g. oxygen dissociation curve, immune system, transport)</p> <p><b>1.4.3. Blood circulation in mammals</b></p> <p>Definition of blood circulation Structure of the human heart. Heart beat Types of blood circulation</p> <p>Difference between systemic and pulmonary circulation</p> <p><b>1.4.4. Some disorders of blood circulatory system.</b></p>	<p>Use chart, dissect mammals and fish</p>
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<p>51. Explain different types of heterotrophic nutrition</p> <p>53. State need for digestion</p> <p>52. Explain different stages of digestion</p> <p>53. Draw and label male and female reproductive systems.</p> <p>54. Explain physiology of human reproductive system.</p>	<p><b>1.5. HETEROTROPHIC NUTRITION:</b></p> <p><b>1.5.1.</b> Food values, energy needs variety of feeding methods, and balanced diet</p> <p><b>1.5.2.</b> Need for digestion , Alimentary canal and control of digestion</p> <p>1.5.3. Digestion in man</p> <p>1.5.4. Digestion of cellulose</p> <p><b>1.6. HUMAN REPRODUCTION</b></p> <p><b>1.6.1. Anatomy of reproductive organs and systems</b></p> <p>Male reproductive system</p> <p>Female reproductive system.</p> <p>Physiology of the male reproductive system</p> <p>Physiology of the female reproductive system</p>	<p>- Use charts and diagrams.</p> <p>- Dissect a mammal and observe the digestive organs.</p> <p>- Use charts</p>
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<p>55. Explain phases of spermatogenesis and Oogenesis</p> <p>56. Draw and label the structure of a spermatozoa and an egg.</p> <p>57. Explain phases of a menstrual cycle</p> <p>58. Determine fertile and infertile periods in a woman</p> <p>59. Explain hormonal control of the menstrual cycle</p> <p>60. State stages in the process of fertilisation and their consequences</p> <p>61. Describe available contraceptive methods and explain their</p>	<p><b>1.6.2. Gametogenesis</b>  Phases of the spermatogenesis  Phases of the Oogenesis  Diagram of a spermatozoa  Diagram of an egg</p> <p><b>1.6.3. Menstrual cycles in a woman</b>  Follicular phase  Ovulation  Luteinizing phase.  Fertile periods  Infertile periods</p> <p>Hormonal control of menstrual cycle</p> <p><b>1.6.4. Fertilisation</b>  Stages  Consequences</p> <p><b>1.6.5. Contraception and Birth control</b>  Advantages</p>	<p>Guided discussion on researched information - collected by students on menstrual cycle of a woman</p>
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<p>advantages /disadvantages</p> <p>62. State and differentiate types of skeleton.</p> <p>62. Describe structure and arrangement of the skeleton, joints and muscles.</p> <p>63. State functions of skeleton, joints and muscles.</p> <p>64. Determine relationship between structure of skeleton, joints and muscle in animals and their movement.</p> <p>65. Explain mechanism of muscle contraction.</p>	<p>Disadvantages Rate of success</p> <p><b>1.7. SUPPORT AND MOVEMENT</b></p> <p><b>1.7.1. Types of skeleton in animals:</b></p> <ul style="list-style-type: none"> <li>- Hydrostatic (Earthworm)</li> <li>- Exo-skeleton (Insect)</li> <li>- Endo- skeleton (Vertebrate)</li> </ul> <p><b>1.7.2. Structure and arrangement of muscles, joints, and skeleton in selected animals to account for their movement.</b></p> <p><b>1.7.3. Function of the skeleton, joints and muscles</b></p> <p><b>-Movement</b></p> <ul style="list-style-type: none"> <li>- in water (living Fish)</li> <li>- on land (Walking, jumping, crawling)</li> <li>- in air (Flying)</li> <li>- Amoeboid movement</li> </ul> <p><b>1.7.4. Mechanism of muscle contraction</b></p>	<p>Guided by the teacher, the learners:</p> <ul style="list-style-type: none"> <li>-compare skeleton of dead insect and that of a dead vertebrate</li> <li>-Observe antagonistic muscle block and dissect out the flexible backbone of a <i>fish</i>.</li> <li>-Dissect the hind limb and the pelvic region of a <i>frog</i> and a <i>rabbit</i> to observe the antagonistic muscles, the joints and the process to muscle attachment on the skeleton.</li> <li>-Examine a <i>chicken</i> skeleton to observe the modification of the forelimb and sternum</li> <li>-Observe movement of different animals such man, grasshopper, frog, lizard, snake</li> <li>-Observe movement of birds and</li> </ul>
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<p>66. Define a species with examples</p> <p>67. Determine resemblance criteria</p>	<ul style="list-style-type: none"> <li>- Recall of types of muscles</li> <li>- Properties of muscles</li> <li>-Excitation leading to muscle contraction</li> <li>- Structure of motor unit/ end plate</li> <li>- The sliding filament theory of muscle contraction</li> <li>- Energy supply for the muscle contraction</li> </ul> <p><b>CHAPTER 2: GENETICS</b></p> <p><b>2.1. Notion of species</b></p> <p>Definition &amp; examples</p> <p>Criteria of resemblance within species</p> <p>Variations within species</p>	<p>insects</p> <ul style="list-style-type: none"> <li>-Use of the wall charts and prepared slides, look at electron micrographs to describe types of muscles.</li> <li>-Use of meat muscle to illustrate the elasticity of muscle.</li> <li>-Excite a frog leg muscle by means of needles or electric shock (<i>use batteries</i>) to observe the contraction.</li> <li>-Learners excite their biceps to observe the process of contraction and relaxation of muscles.</li> <li>- The ability to fold ones tongue, using the left or right hands and the size of human</li> </ul>
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<p>68. Explain factors of variation</p> <p>69. Differentiate between genetics and inheritance</p> <p>70. Distinguish monohybridism with dominance from monohybridism without dominance</p> <p>71. Differentiate dominant alleles from recessive alleles</p> <p>72. Explain Mendel's laws</p> <p>72. Define dihybrid inheritance, independent gene and linked gene</p> <p>73. Use Punnet squares to interpret results of crossing</p> <p>74. Define mutation and state types of mutations.</p>	<p><b>2.2. Genetics and heredity</b></p> <p><b>2.3 Monohybridism</b></p> <p>With dominance</p> <p>Without dominance</p> <p>Sex determination</p> <p>Sex-linked heredity</p> <p>Dominant and recessive alleles</p> <p>Mendel's laws</p> <p><b>2.4. Dihybrid inheritance</b></p> <p>Independent genes</p> <p>Linked genes</p> <p><b>2.5. Mutations</b></p> <p>Definition</p> <p>Types of mutation (genetic and</p>	<p>- Apply genetics scheme before generalizing</p>
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<p>75. State agents of mutation</p> <p>76. Explain mechanism of blood group inheritance and the Rhesus factor.</p> <p>77. Use scientific facts to explain origin of living things.</p> <p>78. State and explain theories of evolution</p> <p>79. Establish evolutionary link between the theory of evolution and the modern scientific facts</p> <p>80. State evolutionary trend of human</p>	<p>chromosomal mutations) Agents of mutation</p> <p><b>2.6. Transmission of some hereditary diseases:</b> Blood group inheritance Rhesus factor inheritance</p> <p><b>CHAPTER 3. EVOLUTION</b></p> <p><b>3.1. Origin of life</b> (special creation and spontaneous generation, big bang theory, Miller theory, shift from water to land and air)</p> <p><b>3.2. Theories of evolution</b> (Lamarckism, Darwinism, Neo-Darwinism)</p> <p><b>3.3. Evidence for evolution</b> (Fossils and comparative anatomy)</p> <p><b>3.4. Human evolution</b></p>	<p>- Guided by the teacher, learners discuss their point of view on theory of evolution.</p> <p>- Learners analyze and compare photographs or fossils related to evolution. E.g. what is the evolutionary link between a photograph of an <i>Archaeopteryx</i> and the actual birds, why the embryo of all vertebrates resemble at their</p>
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<p>81. Mention dominant groups of organisms at different geological eras of the earth's existence</p> <p>82. Suggest evidence for present-day evolution</p> <p>83. Define the following basic concepts: ecology, habitat , biocoenosis, biomass, biomes, ecosystem, population, community, biosphere, niche, environment</p> <p>84. State ecological factors and explain the effect of</p>	<p><b>3.5. Summary of geological eras of the earth's existence and dominant groups of organisms</b></p> <p><b>3.6. Present-day evolution:</b> Industrial melanism, peppered moth, resistance to antibiotic, fungicides and insecticides, importance of artificial selection in domestic animals. Hybrid vigour</p> <p><b>CHAPTER 4. ECOLOGY</b></p> <p><b>4.1. Definitions</b> Ecology, Habitat, Biocoenosis, Biomass, Biome, Ecosystem, Population, Community, Biosphere, Niche, Environment.</p> <p><b>4.2. Ecological factors</b> biotic factors.</p>	<p>early stage? Learners will make research and present their findings - Teacher asks questions to students and guide them</p> <p>Teacher helps students to define the concepts by questions</p> <p>- Use charts</p>
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<p>each factor on living organisms.</p> <p>85. Distinguish components of a biotope, biocoenosis and an ecosystem</p> <p>86. Define terms: autotrophy, heterotrophy, food chain, food web, ecological pyramid, energy flow, biocoenosis productivity, competition, saprophytism, parasitism, predation, commensalisms, symbiosis</p> <p>87. Explain the relations between producer-</p>	<p>abiotic factors</p> <p><b>4.3. Exploration of different ecosystems</b> (aquatic, terrestrial and aerial)</p> <p>components of a biotope  components of a biocoenosis  components of an ecosystem</p> <p><b>4.4. Relationships between living organisms in the same biological community</b></p> <p>Relations: autotrophy, heterotrophy, food chain, food web, ecological pyramid, energy flow, biocoenosis productivity, competition, saprophytism, parasitism, predation, commensalism, symbiosis</p> <p>Relations producer-consumer</p>	
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<p>consumer in a biocoenosis</p> <p>88. Give examples of a food chain and food web</p> <p>89. Explain what is a consumer in a food chain</p> <p>90. Describe water cycle, carbon cycle and nitrogen cycle</p> <p>91. Explain natural equilibrium</p> <p>92. Explain how man misuses and degrades ecosystems</p>	<p>Food chains</p> <p>Food webs</p> <p>Consumer in a food chain</p> <p><b>4.5. Biogeochemical cycles;</b></p> <p>Water cycle</p> <p>Carbon cycle</p> <p>Nitrogen cycle</p> <p><b>4.6.Natural Equilibrium</b></p> <p><b>4.6.1. Degradation of ecosystems:</b></p> <p>Deforestation</p> <p>Bush - fires</p> <p>Pollution</p> <p>Global warming</p> <p>Pouching</p> <p>Demographic explosion</p>	<p>- Field trip to see different degraded ecosystems</p>
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<p>93. Determine consequences of Pollution from industrial and household wastes.</p> <p>94. Demonstrate human role in conservation of environment</p> <p>95. Explain dangers of pesticide use in the production and storage of food commodities from ecological point of view</p>	<p><b>4.6.2. Pollution</b> Consequences of industrial and household wastes pollution</p> <p><b>4.6.3. Nature conservation</b> Reforestation</p> <p>Protection of national parks and game reserves.</p> <p>Soil conservation</p> <p>Protection against pollution and Global warming.</p> <p>Protection of endangered species. (Gorillas, crocodiles, orchids...)</p> <p>Danger pesticides in agriculture</p>	<p>Visit industrial sewages</p> <p>Teachers should organize visits/tours to national parks and game reserves</p>
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**Summary table of distribution of chapters (content) and period's allocation per term in form six**

TERM	CONTENT	PERIODS	
Term 1	<b>CHAPTER 1: ANIMAL PHYSIOLOGY</b> 1.1. Coordination; - Nervous system and sense organs  - Endocrinology	Organisation of the nervous system	7
		Nerve physiology	7
		Sense organs	9
		Endocrinology	9
		Comparison between nervous and endocrine system	3
	1.2. Homeostasis	Homeostasis	7
		Internal environment regulation	
		Excretion	5
		Blood glucose level regulation	7
		Osmoregulation	7
		Thermoregulation, Acid-base balance and some adaptations for homeostasis	9
	<b>TOTAL</b>	<b>70</b>	

Term 2	1.3. Respiration and gaseous exchange		8	
	1.4. Transport in animals		10	
	1.5. Heterotrophic nutrition		10	
	1.6. Reproduction	Structure of the male and female reproductive systems		4
		Gametogenesis and structure of gametes		4
		Menstrual cycles in woman		4
		Fertilisation		2
		Contraception and birth control		4
	1.7. Support and movement	Types of skeleton in animals		4
		Structure and arrangement of muscles		5
		Functions of skeletons, joints and muscles		3
		Movements		8
		Mechanism of muscle contraction		4
		<b>TOTAL</b>		<b>70</b>

Term 3	<b>CHAPTER 2: GENETICS</b>	Notion of a species and definitions of genetics and inheritance	4
		Monohybrid inheritance	5
		Dihybrid inheritance	3
		Blood group and Rhesus factor inheritance	3
		Mutation and variations	5
	<b>CHAPTER 3: EVOLUTION OF SPECIES</b>	Origin of life	3
		Theories of evolution	4
		Evidence of evolution	6
		Human evolution	4
		Summary of geological eras	2
		Present-day evolution	5

	<b>CHAPTER 4: ECOLOGY</b>	Definition, terminologies and Ecological factors	5
		Exploration of different ecosystems	4
		Relationships of living organisms in the same biological community	8
		Recycling of nutrients (Biogeochemical cycles)	4
		Natural Equilibrium	5
	<b>TOTAL</b>	<b>70</b>	
<b>TOTAL NUMBER OF PERIODS IN FORM SIX</b>			<b>210</b>

#### **IV. METHODOLOGY**

The study of Biology in Advanced Level will be based on: - observation, description, carrying out and interpretation of practical experiments. This emphasizes the importance of outings, excursions for collection of specimens and the Practical sessions out in the field.

- The teacher has to carry out practicals during the course of teaching.
- The teacher should stress the need for precision in both oral and written expression during the presentation of observed facts and interpretation of experiments carried out by the student(s).
- The manipulation must be done with outmost accuracy. Diagrams illustrating the material content must be clear and representative.

## **V. EVALUATION**

A regular and continuous check-up and confirmation of acquired knowledge is indispensable.

This provides a feedback on progress of teaching and assurance that, the necessary and sufficient elements to be imparted have been comprehended according to stated objectives.

The continuous assessments must point out not only the acquisition of knowledge theoretically but also the skills and their applications.

- Individual as well as groups evaluations will be performed depending on tasks assigned to students e.g. some tasks requiring and promoting the spirit of thinking, reasoning and working together will be assessed taking the whole groups together.
- Oral tests will be given to allow the development in a student, of the capacity of oral expression, sense of precision and spirit of summarizing given information.
- Students will be evaluated on their practical records: - investigations, laboratory experimental work etc...

Written short tests will be administered as well as long essay types to test assimilation of information and the ability to synthesize, apply and evaluate the information in problem solving.



## **VI. PARTICULAR FACTORS**

The teaching of Biology will always start from concrete and real facts. It will therefore be based on observations of natural living material, collection of specimens or analysis of real facts.

- The teacher(s) guides are useful but the teacher must remember that these (guides) do not always respond to all requirements of the lessons. He must therefore get interested in other available teaching - learning materials, and other Audio - visual Aids which are relevant to the course.
- It is advisable that young teachers (new in profession) take maximum care in preparing the lessons well according to specified topics.
- It is requested that teachers should no longer group living organisms into former two kingdoms (Plants and Animals) but should follow the new five kingdoms system.
- Practical work is emphasized.

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