آغا خان یونیورسٹی ایگزامینیشن بورڈ

AGA KHAN UNIVERSITY EXAMINATION BOARD

Pacing Guide for Teachers

BIOLOGY (BOTANY)

Grade XII

(Theory)

Number of weeks: 28

Number of periods per week: 3

Key Textbook: Biology for Grade 12, Punjab Textbook Board, Lahore

Teacher Developer(s): Rukhshinda Aftab

Institution(s): Aga Khan Higher Secondary School, Karachi

Topic	Total Periods
15.Homeostasis	5

Sub-Topic	Range of SLOs	Periods (40 mins)
15.3 Osmoregulation in Plants	15.3.1,15.3.3	1
	15.3.2(a+b)	1
	15.3.2(c+d)	1
15.4 Excretion in Plants	15.4.1-15.4.2	1
15.8 Thermoregulation in Plants	15.8.1	1

Learning Resources

- A Textbook of Biology for Grade XII by Sindh Textbook Board, Jamshoro
- Textbook of Biology Grade XI by National Book Foundation as Federal Textbook Board, Islamabad
- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Hands-On Experiments:

Conduct hands-on experiments to demonstrate osmoregulation. For instance, place plant leaves in different solutions with varying salt concentrations and observe how they respond by wilting or becoming turgid. Similarly, demonstrate thermoregulation by observing how different leaf colours absorb and reflect light, affecting temperature.

Activity 2:

Interactive Discussions:

Engage students in discussions about the importance of osmoregulation and thermoregulation for plant survival and growth. Encourage critical thinking by asking questions about how these processes might affect crop yield, ecosystem balance, and plant diversity.

Activity 3:

Case Studies:

Present case studies of plants that have evolved specialised adaptations for osmoregulation and thermoregulation in extreme environments. Discuss how desert plants, aquatic plants, or plants in alpine regions manage their water and temperature needs.

Further Resources

For additional resources related to teaching, learning and formative assessments, please refer to **Learn Smart Classroom by Knowledge Platform:**

https://akueb.knowledgeplatform.com/login

Topic	Total Periods
16.Support and Movement	5

Sub-Topic	Range of SLOs	Periods (40 mins)
16.1 Support in Plants	16.1.1	1
	16.1.2-16.1.3	1
16.2 Movement in Plants	16.2.1-16.2.2	1
	16.2.3-16.2.5	1
	16.2.6-16.2.8	1

Learning Resources

- A Textbook of Biology for Grade XII by Sindh Textbook Board, Jamshoro
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- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Project-based learning approach:

Students can collaborate in groups to explore various types of plant movements and deliver presentations to the class. This project-based learning approach empowers students to explore the subject matter and share their findings with their peers.

Activity 2:

Cross-Sectional Drawings:

Have students create their own cross-sectional drawings of plant stems, showing the arrangement of supporting tissues. This hands-on approach encourages them to carefully observe and understand plant anatomy.

Activity 3:

Plant Dissections:

If feasible, conduct plant dissections to reveal the internal structures and tissues. Discuss the roles of each type of tissue in providing support, conducting water and nutrients, and storing resources.

Activity 4:

Virtual Resources:

Utilise online resources, virtual labs, and interactive animations to provide students with a closer look at the microscopic details of supporting tissues and how they work together.

https://www.youtube.com/watch?v=xWUuDM1g4Rg

Further Resources

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Topic	Total Periods
17. Coordination and Control	4

Sub-Topic	Range of SLOs	Periods (40 mins)
17.2 Coordination in Plants	17.2.1 - 17.2.2	1
	17.2.3	3

Learning Resources

- A Textbook of Biology for Grade XII by Sindh Textbook Board, Jamshoro
- Textbook of Biology Grade XI National Book Foundation as Federal Textbook Board, Islamabad
- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Group Projects:

Assign groups of student different plant hormones to research. Have them create presentations that cover hormone functions, sources, and effects, promoting collaborative learning.

Activity 2:

Interactive Discussions:

Engage students in discussions about the importance of hormone balance in plant growth. Encourage them to think critically about how an imbalance might affect plant health.

Activity 3:

Cross-Disciplinary Connections:

Connect plant hormones to other subjects like chemistry (discussing hormone structures), biology (cellular responses to hormones), and agriculture (hormonal applications in crop production).

Activity 4:

Post-Test:

Conduct a post-test using multiple-choice questions (MCQs), constructed-response questions (CRQs), or essay-response questions (ERQs) either from previous AKU-EB exam papers or ones created by the teacher. This post-test aims to gauge students' comprehension of the subject content.

Further Resources

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Topic	Total Periods
18.Reproduction	11

Sub-Topic	Range of SLOs	Periods (40 mins)
18.1 Asexual Reproduction in Plants	18.1.1-18.1.4	1
	18.1.5(a)	1
	18.1.5(b+c), 18.1.6	1
18.2 Photoperiodism	18.2.1	1
	18.2.2	1
	18.2.3	1
18.3 Sexual Reproduction in Plants	18.3.1	1
	18.3.2-18.3.3	1
	18.3.4	1
18.4 Germination in Plants	18.4.1-18.4.2	1

	18.4.3	1

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- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Reading and Discussion:

Assign readings on photoperiodism and have students discuss their understanding in small groups or as a class. Encourage them to ask questions and share insights.

Activity 2:

Visual Diagrams:

Use labelled diagrams or flowcharts to illustrate the stages of the angiosperm life cycle, including alternation of generations, pollination, fertilization, seed formation, and dispersal.

Activity 3:

Seed Germination Experiment:

Provide seeds from different angiosperm species and have students germinate them under controlled conditions. This allows them to observe the early stages of the life cycle.

Activity 4:

Comparative Analysis:

Compare the life cycles of angiosperms and gymnosperms, discussing the similarities and differences in terms of reproductive structures, processes, and ecological significance.

Quizizz.com:https://quizizz.com/admin/quiz/5cfa7e3c0bb92c001afafcb4/angiosperm.

Further Resources

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Topic	Total Periods
19.Growth and Development	6

Sub-Topic	Range of SLOs	Periods (40 mins)
19.2 Growth and Development in Plants	19.2.1-19.2.3	2
19.3 Phases of Growth in Plants	19.3.1 -19.3.2	1
	19.3.3	1
	19.3.4-19.3.5	2

Learning Resources

- A Textbook of Biology for Grade XII by Sindh Textbook Board, Jamshoro
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- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Tree Ring Analysis:

Discuss the concept of tree rings and how they indicate the age and growth of a tree. Show cross-sections of tree trunks and explain how secondary growth contributes to their formation.

Activity 2:

Cambium Observation:

Examine cross-sections of stems under microscope to locate the vascular cambium and cork cambium. Discuss how these meristematic tissues contribute to secondary growth.

Activity 3:

Comparative Analysis:

Compare primary and secondary growth in terms of their roles, locations, and contributions to plant structure. Use diagrams or charts to highlight the differences.

Activity 4:

Quiz:

https://quizizz.com/admin/quiz/5d66f0f422c847001ceb7270/plant-growth-and-development

Further Resources

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Topic	Total Periods
20.Chromosomes and DNA	19

Sub-Topic	Range of SLOs	Periods (40 mins)
20.1 Structure and Types of Chromosomes	20.1.1	1
	20.1.2	1
	20.1.3	1
	20.1.4	1
	20.1.5	1
20.2 Chromosomal Theory of Inheritance	20.2.1	1
	20.2.2	1
20.3 DNA as the Hereditary Material	20.3.1	2
	20.3.2	1
20.4 DNA Replication	20.4.1	1

20.5 Gene Expression	20.5.1	1
	20.5.2	1
	20.5.3	2
20.6 Mutations	20.6.1-20.6.2	1
	20.6.3	1
	20.6.4	1
	20.6.5	1

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Suggested Activities and/or Formative Assessment

Activity 1:

Video Demonstrations:

The teacher can make use of videos that illustrate the chromosome/DNA structure, encompassing animations that zoom in to reveal the intricate organization of genetic material, the twisting of the double helix, and the bonding between bases. Moreover, these videos can demonstrate the DNA replication process.

https://www.youtube.com/watch?v=GxZXdphMRls

https://www.youtube.com/watch?v=gG7uCskUOrA

https://www.youtube.com/watch?v=5bLEDd-PSTQ

https://www.youtube.com/watch?v=WsofH466lqk

https://www.youtube.com/watch?v=XzVXhemtwmA

https://www.youtube.com/watch?v=dKubylRiN84

Activity 2:

Model Building:

Provide students with materials to build physical models of the DNA double helix using coloured beads or paper strips. This hands-on activity helps students visualise the structure and base pairing.

Activity 3:

Whiteboard Illustrations:

Use whiteboard or digital board illustrations to draw out the processes of transcription and translation while explaining details of each step. This visual aid can help students follow along more effectively.

Activity 4:

Transcription and Translation Play:

Divide students into groups, with each group responsible for acting out either transcription or translation. This kinesthetic approach helps reinforce understanding.

Activity 5:

Quiz:

https://quizizz.com/admin/quiz/5d693cdba7c589001a57a8a4/dna-replication

https://quizizz.com/admin/quiz/5dcf02d6fffaa1001bcb38c1

Further Resources

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Topic	Total Periods
21.Cell Cycle	9

Sub-Topic	Range of SLOs	Periods (40 mins)
21.1 Phases of Cell Cycle	21.1.1-21.1.3	2
	21.1.4	1
21.1 Phases of Cell Cycle 21.2 Mitosis	21.1.5, 21.2.1-21.2.3	1
21.2 Mitosis	21.2.4	1
21.3 Meiosis	21.3.1-21.3.3	2
Meiotic Errors (Non-disjunction)	21.4.1-21.4.2	2

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Suggested Activities and/or Formative Assessment

Activity 1:

Lab Activity (Cell Observation):

Provide microscope slides with prepared onion root tip cells or other dividing cells. Have students observe and sketch the different stages of mitosis.

Activity 2:

Cell Cycle Diagrams:

Create visual diagrams of the cell cycle, highlighting the stages of mitosis and the key events that occur in each phase.

Activity 3:

Comparative Analysis:

Compare mitosis in plant cells and animal cells. Discuss any differences or similarities in terms of cell division patterns and outcomes.

Activity 4:

Video Demonstrations:

The teacher can make use of videos that illustrate the processes of mitosis and meiosis. These visual representations can help students see the dynamic changes that occur during each phase.

https://www.youtube.com/watch?v=ofjyw7ARP1c

https://www.youtube.com/watch?v=nMEyeKQClqI

https://www.youtube.com/watch?v=jjEcHra3484

Activity 5:

Quiz:

https://quizizz.com/admin/quiz/56f021db7027b31117d294c2

https://quizizz.com/admin/quiz/5a54fd54b82c1b10008c5a72/mitosis

https://quizizz.com/admin/quiz/56e2beefad20b7261a674e19/meiosis

Further Resources

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Topic	Total Periods
22.Variation and Genetics	13

Sub-Topic	Range of SLOs	Periods (40 mins)
22.1 Gene and Allele	22.1.1	Can be catered in Practical
22.2. Mendel's Laws of Inheritance	22.2.1-22.2.2 (a+b)	Can be catered in Practical
	22.2.3	Can be catered in Practical
22.3 Incomplete Dominance and Co-dominance	22.3.1	1
22.4 Multiple Allele	22.4.1	1
	22.4.2-22.4.3	1
	22.4.4	2
	22.4.5	1
	22.4.6	1
22.5 Linkage and Crossing over	22.5.1	1

22.6 Sex Determination and Sex Linkage	22.6.1	1
	22.6.2-22.6.3	1
	22.6.4(a)	1
	22.6.4(b)	1
Genetic Disorders	22.7.1-22.7.2	1

Learning Resources

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- Textbook of Biology Grade12 National Book Foundation as Federal Textbook Board, Islamabad
- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Bean Bag Toss Game:

Organise a bean bag toss game where students represent alleles by using different-coloured bean bags. The game demonstrates how alleles segregate during gamete formation.

Activity 2:

Punnett Square Practice:

Provide students with Punnett square worksheets, enabling them to anticipate the results of genetic crosses. This interactive method aids in comprehending allele segregation. Additionally, introduce dihybrid crosses featuring distinct traits. Lead students through the utilisation of Punnett squares to illustrate the independent assortment of alleles for various traits.

Activity 3:

Real-Life Examples:

Provide examples of traits that follow the Law of Independent Assortment, such as hair colour and eye colour. Discuss how these traits are inherited independently.

Activity 4:

Critical Thinking Questions:

Pose questions that challenge students to think critically about scenarios where independent assortment might not apply due to genetic or environmental factors.

Activity 5:

Post-Test Activity:
Teacher can employ multiple-choice questions (MCQs), constructed-response questions (CRQs), and extended-response questions (ERQs) from previous AKU-EB exam papers/ model papers OR online quizzes to provide students with practice opportunities.

https://quizizz.com/admin/quiz/5caf53b9364900001d0c8dce/multiple-alleles

Further Resources

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Topic	Total Periods
25.Ecosystem	7

Sub-Topic	Range of SLOs	Periods (40 mins)
25.1 Introduction	25.1.1	1
	25.1.2	1
25.2 Components of Ecosystem	25.2.1-25.2.3	Can be catered in Practical
	25.2.4-25.2.5	1
25.3 Biogeochemical Cycles	25.3.1-25.3.2	1
	25.3.3-25.3.4	Can be catered in Practical
	25.3.5-25.3.6	Can be catered in Practical
25.4 Ecological Succession	25.4.1 -25.4.2	1
	25.4.3-25.4.4	2

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- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Group Discussions and Projects:

Cycle Presentations: Assign student groups different biogeochemical cycles to research and present. Encourage them to explain the importance of each cycle and its impact on the environment.

Impact Analysis: Have students analyse the human impact on biogeochemical cycles, such as deforestation, pollution, or climate change. Discuss potential solutions and mitigation strategies.

Activity 2:

Practice Worksheets:

The teacher can create worksheets containing various examples or scenarios that require students to discern diverse types of interactions among organisms within an ecosystem.

Activity 3:

Food Chain, Food Web and Energy Pyramid Construction:

Have students create food chains, food web and energy pyramids for different ecosystems, discussing how energy is transferred between trophic levels.

Activity 4:

Invasive Species Case Studies:

Present case studies of invasive species and discuss their impacts on native species and ecosystems. Encourage critical thinking about human interventions.

Further Resources

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Topic	Total Periods
26.Some Major Ecosystems	5

Sub-Topic	Range of SLOs	Periods (40 mins)
26.1 Fresh Water Ecosystem	26.1.1	1
26.2 Lake Ecosystem	26.2.1	Can be catered in Practical
26.3 Terrestrial Ecosystem	26.3.1-26.3.2	2
	26.3.3-26.3.4	1
	26.3.5	1

Learning Resources

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- Campbell, Reece. Biology (A Global Approach, Tenth Edition)

Suggested Activities and/or Formative Assessment

Activity 1:

Students Presentations:

Teachers can form distinct groups and allocate various ecosystems to each group for presentation. This activity fosters students' group collaboration skills and boosts their self-assurance in delivering presentations in the classroom.

Activity 2:

Post-Test:

The teacher can administer a post-test to assess students' learning and gain insights into tailoring their teaching strategies moving forward.

Further Resources

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Note: This teacher-led pacing guide has been developed for AKU-EB affiliated schools to facilitate them by

- ensuring smooth transition of a school's academic year.
- ensuring curricular continuity in schools.
- predicting the time and pace of syllabi implementation.

This document also contains **suggested activities and/or formative assessments** that may enhance the learning experience. Please note that these activities are meant to serve as suggestions. As educators, you have the flexibility and autonomy to adapt and modify them to best suit the needs of your students and the dynamics of your classroom.

You are advised to use an ad-blocker while accessing the websites and web resources. In case any website is not functional for any reason, you may inform us at examination.board@aku.edu for an alternative or search material via any search engine.