Marietta City Schools

2025–2026 District Unit Planner

Teacher(s)	IB Biology PLC	**Subject group and course**	Group 4/IB Biology Y2 SL		
Course part and topic	Unit 2: Responding to the Environment: Plant Systems C1.2 and C1.3 Review Unit Content B3.1.7-3.1.10, B3.2.7-B3.2.10, D2.3.1-2.3.6, D3.1.8-3.1.12	**SL or HL/Year 1 or 2**	SL Y2	**Dates**	6 weeks
Unit description and texts		**DP assessment(s) for unit**			
Adaptations are forms that correspond to function. These adaptations persist from generation to generation because they increase the chances of survival. Systems are based on interactions, interdependence and integration of components. Systems result in emergence of new properties at each level of biological organization. Living things have mechanisms for maintaining equilibrium and for bringing about transformation. Environmental change is a driver of evolution by natural selection. Plant systems are multicellular eukaryotes that are made up of tissue systems and organ systems that perform specific functions: Tissue systems These systems are made up of different types of cells that perform specific functions. There are two types of tissue systems in plants: meristematic and permanent. Meristematic tissue cells are found in regions of the plant where cell division and growth are constant. These cells are either undifferentiated		• Unit Summative assessment • Projects/Practicals • Formative/Summative assessment quizzes per subtopic to check for understanding Applications of Skills (AOS): • Measure the rate of cellular respiration – what affects cellular respiration rate? (C1.2) • Thin layer or paper Chromatography- pigmentation of spinach leaves – calculate Rf values – identify pigments by color and value (C1.3) • Determine the rate of photosynthesis from data for oxygen production and carbon dioxide consumption for varying wavelengths – plot data to make an action spectrum (C1.3) • Rates of Photosynthesis Lab – limiting factors (C1.3) • Students should be able to draw plan diagrams from micrographs to identify the relative positions of vascular bundles, xylem, phloem, cortex and epidermis. Students should annotate the diagram with the main functions of these structures. • Students should use micrographs or perform leaf casts to determine stomatal density. • Students should be able to draw diagrams from micrographs to identify vascular bundles, xylem and phloem, cortex and epidermis. • Students should be able to measure changes in tissue length and mass, and analyse data to deduce isotonic solute concentration. Students should also be able to use		

or partially differentiated, and they continue to divide and contribute to the plant's growth. Permanent tissue, on the other hand, is made up of plant cells that are no longer actively dividing. Organ systems Plants have two distinct organ systems: the shoot system and the root system. The shoot system includes the leaves, stems, and reproductive parts of the plant, such as flowers and fruits. The root system is usually underground and supports the plant, absorbing water and minerals. These two systems work together to deliver water and nutrients to the entire plant. Pearson Standard Level Biology for the IB Diploma Program 3rd Edition New IB Biology Guide First Assessment 2025	standard deviation and standard error to help in the analysis of data. Students are not required to memorize formulae for calculating these statistics. Standard deviation and standard error could be determined for the results of this experiment if there are repeats for each concentration. This would allow the reliability of length and mass measurements to be compared. Standard error could be shown graphically as error bars.

INQUIRY: Establishing the purpose of the unit

Unit Statement of Inquiry: The structure of plant systems allows plants to respond to their environment in order to maintain homeostasis in a changing environment.

Core Ideas: Cellular Energy: Photosynthesis, Respiration, Fermentation, Gas Exchange, Transport, Neural Signaling, Defense against Disease, Reproduction/Germination, & Homeostasis

Phenomenon:
The therapeutic potential of extracts from the leaves and seeds of Cajanus cajan (pigeon pea), leaves of *Zanthoxylum zanthoxyloides* (artar root) and leaves of *Carica papaya* (papaya) by extracting molecules in the structures and applying them to blood samples from Sickle Cell Disease patients is under investigation.

Crosscutting Concepts:
- Structure & Function
- Systems & System models
- Cause and Effect
- Interactions & Equilibrium
- Stability & Change

SEP:

- Analyze & Interpret Data
- Developing and Using Models
- Planning and Carrying out Investigations
- Use Mathematics and Computational Thinking

ACTION: teaching and learning through inquiry

Content/skills/concepts—essential understandings **U = Understandings** **NOS = Nature of Science** **A = Applications** **S = Skills**	**Learning process** *Check the boxes for any pedagogical approaches used during the unit. Aim for a variety of approaches to help facilitate learning.*
Students will know the following content/Students will grasp the following concepts: Unit starts with a review of the following topics C1.2 and C1.3 to better understand plant system topics. **C1.2 Cell Respiration (Interaction and Interdependence - Molecules)** **GQ -** ● **What are the roles of hydrogen and oxygen in the release of energy in cells?** ● **How is energy distributed and used inside cells?** **Guidance:** **C1.2.1—ATP as the molecule that distributes energy within cells** Include the full name of ATP (adenosine triphosphate) and that it is a nucleotide. Students should appreciate the properties of ATP that make it suitable for use as the energy currency within cells. **C1.2.2—Life processes within cells that ATP supplies with energy** Include active transport across membranes, synthesis of macromolecules (anabolism), movement of the whole cell or cell components such as chromosomes. **C1.2.3—Energy transfers during interconversions between ATP and ADP** Students should know that energy is released by hydrolysis of ATP (adenosine triphosphate) to ADP (adenosine diphosphate) and phosphate, but energy is required to synthesize ATP from ADP and phosphate. Students are not required to know the quantity of energy in kilojoules, but students should appreciate that it is sufficient for many tasks in the cell. **C1.2.4—Cell respiration as a system for producing ATP within the cell using energy released from carbon compounds**	Learning experiences and strategies/planning for self-supporting learning: Flipped and In person Lecture Socratic Seminar Small Group/Pair Work PowerPoint Lecture Notes Individual Presentations Group Presentations Student Lecture/Leading the class Interdisciplinary Learning Hands-on and Active learning Details: Modeling, Think/Pair/Share, CER, Writing Prompts, Videos, etc. Accommodations: ● *SWD/504 – Accommodations Provided* ● *ELL – Reading & Vocabulary Support* ● *Intervention Support* ● *Extensions – Enrichment Tasks and Project* Guidance:

Students should appreciate that glucose and fatty acids are the principal substrates for cell respiration but that a wide range of carbon/organic compounds can be used. Students should be able to distinguish between the processes of cell respiration and gas exchange. **C1.2.5—Differences between anaerobic and aerobic cell respiration in humans** Include which respiratory substrates can be used, whether oxygen is required, relative yields of ATP, types of waste product and where the reactions occur in a cell. Students should be able to write simple word equations for both types of respiration, with glucose as the substrate. Students should appreciate that mitochondria are required for aerobic, but not anaerobic, respiration. **C1.2.6—Variables affecting the rate of cell respiration** **AOS: Students should make measurements allowing for the determination of the rate of cell respiration. Students should also be able to calculate the rate** **LQ -** • **In what forms is energy stored in living organisms?** • **What are the consequences of respiration for ecosystems?** **C1.3 Photosynthesis (Interaction and Interdependence - Molecules)** **GQ -** • **How is energy from sunlight absorbed and used in photosynthesis?** • **How do abiotic factors interact with photosynthesis?** **Guidance:** **C1.3.1—Transformation of light energy to chemical energy when carbon compounds are produced in photosynthesis** This energy transformation supplies most of the chemical energy needed for life processes in ecosystems. **C1.3.2—Conversion of carbon dioxide to glucose in photosynthesis using hydrogen obtained by splitting water** Students should be able to write a simple word equation for photosynthesis, with glucose as the product. **C1.3.3—Oxygen as a by-product of photosynthesis in plants, algae, and cyanobacteria** Students should know the simple word equation for photosynthesis. They should know that the oxygen produced by photosynthesis comes from the splitting of water. **C1.3.4—Separation and identification of photosynthetic pigments by chromatography** **AOS: Students should be able to calculate Rf values from the results of chromatographic separation of photosynthetic pigments and identify them by color and by values. Thin-layer chromatography or paper**	❖ Details of the metabolic pathways of cell respiration are not needed but the substrates and final waste products should be known. ❖ There are many simple respirometers which could be used. Students are expected to know that an alkali is used to absorb CO_2, so reductions in volume are due to oxygen use. Temperature should be kept constant to avoid volume changes due to temperature fluctuations. ❖ Students should know that visible light has wavelengths between 400 and 700 nanometres, but they are not expected to recall the wavelengths of specific colours of light. ❖ Water free of dissolved carbon dioxide for photosynthesis experiments can be produced by boiling and cooling water. ❖ Paper chromatography can be used to separate photosynthetic pigments but thin layer chromatography gives better results. ❖ IB Drawing Guidance Note: All review topics will be covered using Flippled lessons in Schoology and connected to the Unit content in class activities

chromatography can be used. **C1.3.5—Absorption of specific wavelengths of light by photosynthetic pigments** Include excitation of electrons within a pigment molecule, transformation of light energy to chemical energy and the reason that only some wavelengths are absorbed. Students should be familiar with absorption spectra. Include both wavelengths and colors of light in the horizontal axis of absorption spectra. **C1.3.6—Similarities and differences of absorption and action spectra** **AOS: Students should be able to determine rates of photosynthesis from data for oxygen production and carbon dioxide consumption for varying wavelengths. They should also be able to plot this data to make an action spectrum.** **C1.3.7—Techniques for varying concentrations of carbon dioxide, light intensity, or temperature experimentally to investigate the effects of limiting factors on the rate of photosynthesis** **AOS: Students should be able to suggest hypotheses for the effects of these limiting factors and to test these through experimentation.** **NOS: Hypotheses are provisional explanations that require repeated testing. During scientific research, hypotheses can either be based on theories and then tested in an experiment or be based on evidence from an experiment already carried out. Students can decide in this case whether to suggest hypotheses for the effects of limiting factors on photosynthesis before or after performing their experiments. Students should be able to identify the dependent and independent variable in an experiment.** **C1.3.8—Carbon dioxide enrichment experiments as a means of predicting future rates of photosynthesis and plant growth** Include enclosed greenhouse experiments and free-air carbon dioxide enrichment experiments (FACE). **NOS: Finding methods for careful control of variables is part of experimental design. This may be easier in the laboratory but some experiments can only be done in the field. Field experiments include those performed in natural ecosystems. Students should be able to identify a controlled variable in an experiment.** **LQ -** • **What are the consequences of photosynthesis for ecosystems?** • **What are the functions of pigments in living organisms?** **Begin plant system topics** **GQ -**	

- **What adaptations facilitate transport of fluids in plants?**
- **What are the differences and similarities between transport in plants?**

B3.1.7—Adaptations for gas exchange in leaves
Leaf structure adaptations should include the waxy cuticle, epidermis, air spaces, spongy mesophyll, stomatal guard cells and veins.

B3.1.8—Distribution of tissues in a leaf
Students should be able to draw and label a plan diagram to show the distribution of tissues in a transverse section of a dicotyledonous leaf.

B3.1.9—Transpiration as a consequence of gas exchange in a leaf
Students should be aware of the factors affecting the rate of transpiration.

B3.1.10—Stomatal density
Application of skills: Students should use micrographs or perform leaf casts to determine stomatal density.

NOS: Reliability of quantitative data is increased by repeating measurements. In this case, repeated counts of the number of stomata visible in the field of view at high power illustrate the variability of biological material and the need for replicate trials.

B3.2.7—Transport of water from roots to leaves during transpiration
Students should understand that loss of water by transpiration from cell walls in leaf cells causes water to be drawn out of xylem vessels and through cell walls by capillary action, generating tension (negative pressure potentials). It is this tension that draws water up in the xylem. Cohesion ensures a continuous column of water.

B3.2.8—Adaptations of xylem vessels for transport of water Include the lack of cell contents and incomplete or absent end walls for unimpeded flow, lignified walls to withstand tensions, and pits for entry and exit of water.

B3.2.9—Distribution of tissues in a transverse section of the stem of a dicotyledonous plant
Application of skills: Students should be able to draw plan diagrams from micrographs to identify the relative positions of vascular bundles, xylem, phloem, cortex and epidermis. Students should annotate the diagram with the main functions of these structures.

B3.2.10—Distribution of tissues in a transverse section of the root of a dicotyledonous plant
Application of skills: Students should be able to draw diagrams from micrographs to identify vascular bundles, xylem and phloem, cortex and epidermis.
GQ-

- **What factors affect the movement of water into or out of cells?**
- **How do plant and animal cells differ in their regulation of water movement?**

D2.3.1—Solvation with water as the solvent Include hydrogen bond formation between solute and water molecules, and attractions between both positively and negatively charged ions and polar water molecules. **D2.3.2—Water movement from less concentrated to more concentrated solutions** Students should express the direction of movement in terms of solute concentration, not water concentration. Students should use the terms “hypertonic”, “hypotonic” and “isotonic” to compare concentration of solutions. **D2.3.3—Water movement by osmosis into or out of cells** Students should be able to predict the direction of net movement of water if the environment of a cell is hypotonic or hypertonic. They should understand that in an isotonic environment there is dynamic equilibrium rather than no movement of water. **D2.3.4—Changes due to water movement in plant tissue bathed in hypotonic and those bathed in hypertonic solutions** **Application of skills:** Students should be able to measure changes in tissue length and mass, and analyse data to deduce isotonic solute concentration. Students should also be able to use standard deviation and standard error to help in the analysis of data. Students are not required to memorize formulae for calculating these statistics. Standard deviation and standard error could be determined for the results of this experiment if there are repeats for each concentration. This would allow the reliability of length and mass measurements to be compared. Standard error could be shown graphically as error bars. **D2.3.5—Effects of water movement on cells that lack a cell wall** Include swelling and bursting in a hypotonic medium, and shrinkage and crenation in a hypertonic medium. Also include the need for removal of water by contractile vacuoles in freshwater unicellular organisms and the need to maintain isotonic tissue fluid in multicellular organisms to prevent harmful changes. **D2.3.6—Effects of water movement on cells with a cell wall** Include the development of turgor pressure in a hypotonic medium and plasmolysis in a hypertonic medium. GQ- **How does asexual or sexual reproduction exemplify themes of change or continuity?** **What changes within organisms are required for reproduction?** **D3.1.8—Sexual reproduction in flowering plants** Include production of gametes inside ovules and pollen grains, pollination, pollen development and fertilization to produce an embryo. Students should understand that reproduction in flowering plants is sexual, even if a plant species is hermaphroditic. **D3.1.9—Features of an insect-pollinated flower** Students should draw diagrams annotated with names of structures and their functions.	

D3.1.10—Methods of promoting cross-pollination Include different maturation times for pollen and stigma, separate male and female flowers or male and female plants. Also include the role of animals or wind in transferring pollen between plants. **D3.1.11—Self-incompatibility mechanisms to increase genetic variation within a species** Students should understand that self-pollination leads to inbreeding, which decreases genetic diversity and vigour. They should also understand that genetic mechanisms in many plant species ensure male and female gametes fusing during fertilization are from different plants**.** **D3.1.12—Dispersal and germination of seeds Distinguish seed dispersal from pollination.** Include the growth and development of the embryo and the mobilization of food reserves.	
Students will be assessed daily with classwork, discussions, group work, and reflections using a variety of formats with a focus on the applications and skills provided in the syllabus.	**Formative assessment:** Quiz/Test Project/Model CER/Reflection Essay/Writing Assignment

Students will be assessed per subtopic and then at the end of the unit (Topic) to ensure understanding using IB exam style questions, modeling, reflection, lab reports, and writing prompts Students may be aware of many of the concepts within this unit, so building on prior knowledge using scaffolding techniques to aid students in a deeper understanding and extending learning to ensure that students can meet the goals set by the unit.	**Summative assessment:** Quiz/Test Project/Model CER/Reflection Essay/Writing Assignment

	Differentiation: Affirm Identity - build self-esteem Value Prior Knowledge Scaffold Learning Extend Learning Details: Many concepts may be familiar to the students and others will need more scaffolding and extension.

Approaches to learning (ATL)

Check the boxes for any explicit approaches to learning connections made during the unit. For more information on ATL, please see the guide.

Thinking - Asking questions and defining problems
Social Communication- Constructing Explanations/Engaging in Argument from Evidence
Self-management - Carrying out Investigations
Research- Developing and using models

Language and learning	TOK connections	CAS connections
Check the boxes for any explicit language and learning connections made during the unit. For more information on the	*Check the boxes for any explicit TOK connections made during the unit*	*Check the boxes for any explicit CAS connections. If you check any of the boxes, provide a brief note in the "details" section*

IB's approach to language and learning, please see the guide.		*explaining how students engaged in CAS for this unit.*
Activating Background Knowledge Scaffolding for new learning Acquisition of new learning through practice Demonstrating proficiency	Personal and Shared Knowledge Ways of Knowing Areas of Knowledge The Knowledge Framework Details: If a traditional treatment using a medicinal plant was tested in the laboratory and found to be effective, would that make the knowledge of the plant's properties more true? What of a single study disproved the plant's effectiveness as a medical treatment? Would that erase thousands of years of traditional knowledge? Turmeric, for example, hs been used in herbal medicine for thousands of years to relieve digestive problems and inflammation. It is also widely used in culinary dishes. Tumeric Case Study.pdf	Creativity Activity Service Details: Modeling and active participation in the learning process. Creating materials to aid their fellow classmates in understanding a particular concept through peer interaction and team/group activities.

International Mindedness/Aims

International Mindedness: (Research/Reflections/Writing)

Utilizing the outdoor observatory and research related to global plant system enables us to explore and appreciate the natural aspect of living in our area and abroad. Students will have opportunities to explore the school grounds and learn about indigenous plants and natural vegetation whilst also appreciating geographical features, utilising both science and geography skills.

Aims: (Practicals/Activities/Student Reflections/CER Activities)

Design and model solutions to local and global problems in a scientific context
Develop an appreciation of the possibilities and limitations of science
Develop technology skills in a scientific context
Develop the ability to communicate and collaborate effectively
Develop awareness of the ethical, environmental, economic, cultural and social impact of science.

Resources
MCS Science Resources ● Textbook Pearson Biology for the IB Diploma Standard and Higher Level ● IB Biology Guide First Assessment 2025 ● Van de Lagemaat, R. www.inthinking.net: Andorra la Vella, Andorra, 2019. ● IB Biology Schoology Course ● Discovery Education Biology and Chemistry Resources

Stage 3: Reflection—considering the planning, process and impact of the inquiry

What worked well *List the portions of the unit (content, assessment, planning) that were successful*	**What didn't work well** *List the portions of the unit (content, assessment, planning) that were not as successful as hoped*	**Notes/changes/suggestions:** *List any notes, suggestions, or considerations for the future teaching of this unit*
Guided Question Documents and Flipped lessons will be used for Review Items		