LISBON SCHOOL DEPARTMENT
UNIT DESIGN OUTLINE

Unit Title: Principles of Biology (Unit 1)

Unit Designers: Ryan Keith and Olivia Griset

Level(s): Grade 10 Biology Time Span: 6 weeks (first quarter)

Content Area:

☐ Career Prep	☐ Health/PE	☐ M&C Languages	☐ Social Studies
☐ English Language Arts	☐ Mathematics	☒ Science & Tech	☐ Visual & Perf. Arts

Summary of Unit:

In this unit students will be introduced to basic, key concepts related to the study of Biology. Declarative topics will include characteristics of life, anatomy of a microscope, and steps of the scientific method. Students will also be asked to apply the declarative knowledge along with procedural skills such as using a microscope, and problem solving to conduct varied experiments.

Content Standards/Performance Indicators:

A. *Unifying Themes*

A.1. Systems: Students apply an understanding of systems to explain and analyze man-made and natural phenomena.

A.4. Scale: Students apply understanding of scale to explain phenomena in physical, biological, and technological systems.

B. The Skills and Traits of Scientific Inquiry and Technological Design

B.1. Skills and Traits of Scientific Inquiry: Student methodically plan, conduct, analyze date from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis

a. Identify questions, concepts, and testable hypotheses that guide scientific investigations.
b. Design and safely conduct methodical scientific investigations, including experiments with controls.

B.2. The Skills and Traits of Technology Design: Students use a systematic process, tools and techniques, and a variety of materials to design and produce a solution or a product that meets new needs or improves existing designs.

C. *The Scientific and Technological Enterprise*

C.1. Understanding of Inquiry: Students describe key aspects scientific investigations: that they are guided by *scientific principles* and knowledge, that they are performed to test ideas, and that they are communicated and defended publicly.

b. Describe how scientists defend their evidence and explanations using logical arguments and verifiable results.

C4. History and Nature of Science: Students describe the human dimensions and traditions of science, the nature of scientific knowledge, and historical episodes in science that impacted science and society.

E. <u>The Living Environment</u>

E.1. Biodiversity: Students describe and analyze the evidence for relatedness among and within diverse populations of organisms and the importance of biodiversity.

d. Analyze the effects of changes in biodiversity and predict possible consequences.

E.2. Ecosystems: Students describe and analyze the interactions, cycles, and factors that affect short-term and long-term ecosystem stability and change.

b. Describe dynamic equilibrium in ecosystems and factors that can, in the long run, lead to change in the normal pattern of cyclic fluctuations and apply that knowledge to actual situations.

E.3. Cells: Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals.

e. Describe the role of regulation and the processes that maintain an internal environment amidst changes in the external environment.

Key Pre-Requistites (Declarative and Procedual Knowledge):

Declarative Knowledge	Procedural
1. Students should know metric units of measure (length, mass, volume). 2. Students should know metric prefixes. 3. Review metric prefixes 4. Prior experience with food chains 5. Definitions of carnivore, herbivore, and omnivore. 6. Have a basic understanding of organisms interactions in nature.	1. Students should be able to use conversion factors to convert between units of measure. 2. Students should be able to use appropriate tools to make accurate measurements.

Enduring Understandings:

The scientific method is a logical approach to problem-solving.
Mathematics is the language of science.
All living things share certain features.
All living things are interconnected.
Energy is transferred through ecosystems.

Essential Questions that Guide and Focus This Unit:

What is the scientific method and how is it used in everyday problem solving?
How is mathematics used to communicate information?
What are features do all living organisms share?
How are microscopes important to the study of life both historically and currently?
How are living things interconnected?
How is energy transferred through ecosystems?

Key Knowledge and Skills students will acquire as a result of this unit (Declarative and Procedural):

Declarative Knowledge:	**Procedural:**
1) Students will understand Problem Solving in Science 2) Students will know the anatomy of a microscope 3) Students will know the Characteristics of Life 4) Students will know the steps to the Scientific Method 5) Students will know that the metric system is a tool of measurement used in many of areas of the world 6) Students will know the history of the Microscope 7) Students will know how energy is transferred through an ecosystem. 8) Students will understand the relationship between photosynthesis and cellular respiration. 9)Students will be able to identify the main differences between food chains and webs. 10. Students will be able to describe the properties of water that make it uniquely important to life.	1) Students will be able to apply problem solving strategy to multiple contexts. 2) Students will be able to design and carry out individually designed experiments. 3) Students will be able to handle and use microscopes properly. 4) Students will be able to make accurate measurements of volume, mass, density, time, length etc. 5) Students will be able to construct and explain a trophic energy pyramid. 6) Students will be able to describe photosynthesis and respiration. 7) Students will construct model ecosystem and evaluated them for understanding of ecosystems.
Key Vocabulary: STEPS TO THE SCIENTIFIC METHOD: Hypothesis, controlled experiment, analyze, data, bias, conclusion, scientific method MEASURMENT: Volume, mass, density, length, time, temperature, metric prefixes PARTS OF A MICROSCOPE: Focus, magnification, base, arm, objective, eye piece, stage, stage clips, body tube, light source, diaphragm ECOLOGY: autotroph, heterotroph, trophic structure, food web, food chain, photosynthesis, respiration, dynamic equilibrium, limiting factors, carrying capacity, habitat, zooplankton, phytoplankton, protista, properties of water, parasitism, commensalisms, ammensalism, competition, succession, survivorship etc.	

How will students provide evidence of their understandings?

(Formative and Summative Assessments/Instructional Activities)

1) **Characteristics of Life**
    a. **Formative Pre-assessment:** Check-in Question: What is biology? What common features do ALL living things share?
    b. **Formative Assessment:** Four person brainstorm on what all living things have in common.
    c. **Instructional Activity:** Direct instruction using pair storm results and PowerPoint with scaffold notes.
    d. **Formative Assessment:** Students identify characteristics of life in pictures of organisms.
    e. **Formal Assessment:** Alien life essay
    f. **Formative Assessment:** Check-in question. What are the characteristics of life? Followed by discussion.
    g. **Formal Assessment:** Life quiz using plant as evidence.
    h. **Summative Assessment:** Part of Unit Exam, essay question using people as evidence.
2) **Problem solving in Science**
    a. **Formative pre-assessment**: check-in question: What is the scientific method? How do you solve a problem in science?

b. **Instructional activity:** Discussion and direct instruction of how to choose clothes or what you want to eat and then relate to how students think using scientific method logic structure to solve daily problems.
c. **Instructional Strategy:** Computer simulations using laptops.
d. **Formative Assessment:** Check-in Q) Outline a way to solve a problem using the scientific method.
e. **Formative Assessment:** M+M activity where students form and design hypothesis, and then experiment and draw conclusions.
f. **Formal Assessment:** Paper Airplane Lab (Scientific Method) (long term project design)
g. **Formative Assessment:** Mr. Baker problem sheet
h. **Formal Assessment:** Scientific Method Take home quiz or in-class quiz
i. **Summative Assessment:** Portion of Unit Exam

3) **Measurements**
   a. **Instructional strategy:** Direct instruction with discussion of metric system, student groups present to class on how to use science tools for measurement.
   b. **Formative Assessment:** Students practice converting between metrics using practice sheet (Peer experts.)
   c. **Formal Assessment:** Measurements and Conversion lab
   d. **Formal Assessment:** Conversion homework
   e. **Formative Assessment:** Conversion check-in
   f. **Formal Assessment:** Take home Quiz/and or in-class quiz
   g. **Summative Assessment:** Portion of unit exam

4) **Microscope**
   a. **Formative pre-assessment:** What is one of the most important tools in biology? Students work in pairs to fill out parts of microscope.
   b. **Instructional Strategy:** Microscopes parts graphic organizer and direct instruction with PowerPoint history video clip. Safe handling and proper usage instruction.
   c. **Formal Assessment:** Microscope Lab(s) 1 and 2
   d. Summative Assessment: Portion of Unit Exam

5) Ecology
   a. Instructional Strategy: Direct instruction with powerpoint and graphic organizers.
   b. Formative Assessment: Ecology homework and reading activities.
   c. Formal Assessmetn: Aquatic Ecosystem Lab Series.

Teaching and Learning experiences used to help students understand:
(Research Supported Instructional Strategies)

- Formative Pre-assessments: (Check-ins and Activators)
- Pair Shares
- Brainstorming
- Student directed learning (group presentations, inquiry and experimental design)
- Inquiry
- Modeling
- Scaffold notes/Graphic Organizers
- Direct instruction supported with technology such as PowerPoint, and video clips
- Vocabulary strategies (review games, note cards, graphic organizers, visualization)
- Venn Diagrams
- Experiential Learning

Provisions for Extending Learning:
Ecosystem Lab series is inquiry driven. Students are encouraged to extend the lab to include more in depth exploration of ecological concepts. With honors classes students will be using the skills developed within this unit to conduct independent research projects. Additionally, students develop skills at writing formal lab reports within the sciences.

How will technology be used to increase student achievement?
Technology was utilized in a multitude of ways during this Unit. They include computer simulations using the laptops, LCD projector use of PowerPoint presentations, and streaming video clips. Additionally, common science technology was utilized, such as microscopes, measuring tapes, electronic balances, digital thermometers etc.

Instructional Resources:
http: pbil.univ-lyon1.fr/ecology/ecology-www.html
food webs: www.gould.edu.au/foodwebs/kids-web.htm
buglopedia: www.bugsurvey.nsw.gov.au/html/buglopedia.html
strange days on planet earth National Geographic Video
United Streaming Microscope Video Clips, Plankton Video Clips

Attach a copy of the unit assessment tool, including criteria for evaluation of student performance/product.

Microscope Practical Quiz

Aquatic Ecosphere Project