This Biology Lesson is designed for 5th Grade students. The lesson will accomplish development of prior knowledge, introduction of new concepts and simple application of learned concepts.

**Stage 1: What do I want the students to know and be able to do?**

From a prior knowledge perspective, I want students to be able to:

1. Have basic knowledge of simple life functions in plants (photosynthesis, transpiration).
2. Know that there are connections from organisms (plants) to their environment (soil, sun). Aware/Knowledge of what a Biome is from prior lesson (Unit 3).
3. Be able to clarify word meaning using context clues and a variety of resources including glossaries, dictionaries and thesauruses (Unit 1).
4. Establish purposes for reading; survey materials; ask questions; make predictions; connect, clarify and extend ideas.
5. Record observations in science journals from Unit 3)
6. Conduct experiments using safety practices (from Unit 1).
7. Form a prediction (hypothesis) through labs in which they infer what they believe will happen.
8. Collect data through experiments
9. Illustrate data on charts or graphs.

We will develop these prior abilities into the students being able to:

1. Understand the elements of simple life functions (photosynthesis, geotropism, phototropism) and describe in detail.
2. Be able to describe the connections from organisms to their environment using appropriate terms (consumer, carnivore, etc.).
3. Use terminology appropriate to scientific topic in their written and oral descriptions.
4. Actively seek evidence in readings to clarify understanding of processes (ex. Finding evidence).
5. Record observations in science journals using scientific vocabulary.
6. Conduct experiments posed in Lab 1 and Lab 2 to explore the simple life functions of geotropism and phototropism.
7. Form hypothesis based on readings in Lab 1 and Lab 2.
8. Collect data during Lab 1 and Lab 2.
9. Illustrate data on a chart in Lab 1 and in Food webs exercises.

During this lesson students will:

1. Learn new vocabulary pertinent to topics and use to describe simple life functions.
2. Conduct labs to demonstrate simple life functions in real time.
3. Collect data through Lab 1 and Lab 2.
4. Illustrate data in charts or graphs in Lab 1 and in Food webs activities.
5. Write descriptions of observations.
6. Formulate hypothesis in Labs using evidence derived from prior knowledge and readings.
7. Identify position within food web of living things based on what they eat.

As a result of this lesson students will be able to describe and understand the chemical reaction of photosynthesis, phototropism and geotropism. Students will be able to identify living creatures (plants and animals) position on the food web based on what they eat.

Stage 2: How will I know that they know and can do it?

Students will demonstrate their understand of new vocabulary through their use verbally and in their descriptions

1. Demonstrate comprehension of vocabulary by use in verbal and written explanation in science journals.
2. Apply the use of scientific inquiry in use of their preformatted science journal during labs.
3. Able to record data accurately, following consistent procedures.
4. Can identify the placement of each type of consumer and producer on the food chain within different ecosystems through use of diagrams.
5. Can explain simple life functions.

Stage 3: What will I need to do to make this happen?

Section includes a description of the types of activities you intend to do linked to your pedagogical teaching philosophy as reflected in your lesson. You should identify specific instructional strategies and management techniques.

Classroom setup accordingly to student's needs, conducive learning structure, rules and safety measures posted and clear. Students will be controlled to establish a pattern in activities for conducting labs that will be used throughout the school year. Eventually, students will be able to act independent of control to follow steps in a consistent and safe manner.

Unit 1 and Unit 2 setup the skills and abilities and structure needed to accomplish Unit 3.

Unit 1

|  |  |  |
| --- | --- | --- |
| Lesson 1 | Lab safety / Class Rules | 1 day |
| Lesson 2 | How to take notes | 1 day |
| Lesson 3 | Learning Process | 1 day |
| Lesson 4 | Preparation for test taking | 1 day |
| Lesson 5 | Tools for Science | 1 day |

Unit 2:

|  |  |  |
| --- | --- | --- |
| Lesson 1 | Length | 1 day |
| Lesson 2 | Mass | 1 day |
| Lesson 3 | Volume | 1 day |
| Lesson 4 | Density | 1 day |
| Lesson 5 | Conversions | 2 days |
| Lesson 1-5 | Review, Assessment, Review | 2 day |
| Lesson 6 | Scientists and Their Contributions | 1 day |

Unit 3:

|  |  |  |
| --- | --- | --- |
| Lesson 1 | Overview of Biological Sciences | 2 days |
| Lesson 2 | Overview of Physical Sciences | 1 day |
| Lesson 3 | Great Observer: Scientific Method Steps 1-3 | 3 days |
| Lesson 4 | Great Observer: Scientific Method Steps 4-5 | 1 week |

Unit 4:

|  |  |  |
| --- | --- | --- |
| Lesson 1 | Categories of Plants | 1 day |
| Lesson 2 | Parts of Plants  Process of Photosynthesis | 2 day |
| Lesson 3 | Plants with seeds | 2 day |

Teacher will consult behavioral management issues firsthand and in private. There will be a progressive order that students will follow before having appropriate corrective action taken. Teacher will demonstrate respect, professionalism and gratitude for education. Teacher will instill and promote values such as gratitude, respect, appropriate behavior and will acknowledge students' emotions and frustrations. Teacher will assist students in achieving through a taught structure of planning, studying and goal directed actions.

Teacher will use modeling, verbal instruction, guided instruction (where students will perform task while I give explicit instruction) constructive feedback, opportunities for student self-reflection, peer assessment, guided practice and multiple means of delivering instruction. Students will work in small groups to complete labs, this will allow for collaboration of understanding. I will consider each student's strength and weakness in constructing lessons. We will learn to lean on our strengths to better develop our weaknesses.

Instruction will be delivered in different ways as will assessment. Instruction will be given verbally, visually (written on boards or projected through digital projector, PowerPoint or other available mediums), video demonstrations, through song, movement and readings.

Instruction will be reinforced through tutoring before and after school, peer tutoring, pairing of students with similar language backgrounds (one stronger in English) and through extended activities.

Assessments include a participation grade. I will mark a point for each day that a student actively participates in class. Participation can be a student asking the teacher a question, helping another student, offering experiences and opinions in discussions and is overall respectful of each person in class. The points are not that significant but will allow me to track how much as student is participating in their education in case there is a lapse in the students’ performance, I will be able to correlate to the amount of participation. This participation point system is also to encourage students to participate.

Vocabulary study will consist of three activities that are worth one point each. Again, this is a method to track the amount of effort a student puts forth in studying and learning new vocabulary. If I observe their inappropriate use of vocabulary, I will be able to link to or dismiss the fact that they complete or did not complete the vocabulary activities. A student may choose to create a rap or song using vocabulary words, create a cross-word and word-search puzzle, complete a worksheet (multiple choice, connect term to definition and fill in blanks) and create flashcards.

**Standards**

IL.1

GOAL: Read with understanding and fluency.

IL.1.A

STANDARD: Apply word analysis and vocabulary skills to comprehend selections.

IL.1.A.2b

> Clarify word meaning using context clues and a variety of resources including glossaries, dictionaries and thesauruses.

IL.1.B

STANDARD: Apply reading strategies to improve understanding and fluency.

IL.1.B.2a

> Establish purposes for reading; survey materials; ask questions; make predictions; connect, clarify and extend ideas.

IL.1.B.2b

> Identify structure (e.g., description, compare/contrast, cause and effect, sequence) of nonfiction texts to improve comprehension.

IL.1.B.2c

> Continuously check and clarify for understanding (e.g., in addition to previous skills, clarify terminology, seek additional information).

IL.1.B.2d

> Read age-appropriate material aloud with fluency and accuracy.

IL.1.C

STANDARD: Comprehend a broad range of reading materials.

IL.1.C.2a

> Use information to form and refine questions and predictions.

IL.1.C.2b

> Make and support inferences and form interpretations about main themes and topics.

IL.1.C.2d

> Summarize and make generalizations from content and relate to purpose of material.

IL.2.B

STANDARD: Read and interpret a variety of literary works.

IL.2.B.2a

> Respond to literary material by making inferences, drawing conclusions and comparing it to their own experience, prior knowledge and other texts.

IL.3

GOAL: Write to communicate for a variety of purposes.

IL.3.A

STANDARD: Use correct grammar, spelling, punctuation, capitalization and structure.

IL.3.A.2

> Write paragraphs that include a variety of sentence types; appropriate use of the eight parts of speech; and accurate spelling, capitalization and punctuation.

IL.3.B

STANDARD: Compose well-organized and coherent writing for specific purposes and audiences.

IL.3.B.2d

> Edit documents for clarity, subjectivity, pronoun-antecedent agreement, adverb and adjective agreement and verb tense; proofread for spelling, capitalization and punctuation; and ensure that documents are formatted in final form for submission and/or publication.

IL.4

GOAL: Listen and speak effectively in a variety of situations.

IL.4.A

STANDARD: Listen effectively in formal and informal situations.

IL.4.A.2a

> Demonstrate understanding of the listening process (e.g., sender, receiver, message) by summarizing and paraphrasing spoken messages orally and in writing in formal and informal situations.

IL.4.A.2b

> Ask and respond to questions related to oral presentations and messages in small and large group settings.

IL.4.A.2c

> Restate and carry out a variety of oral instructions.

IL.4.B.2a

> Present oral reports to an audience using correct language and nonverbal expressions for the intended purpose and message within a suggested organizational format.

IL.4.B.2b

> Use speaking skills and procedures to participate in group discussions.

IL.5.A

STANDARD: Locate, organize, and use information from various sources to answer questions, solve problems and communicate ideas.

IL.5.A.2b

> Organize and integrate information from a variety of sources (e.g., books, interviews, library reference materials, websites, CD/ROMs).

IL.7

GOAL: Estimate, make and use measurements of objects, quantities and relationships and determine acceptable levels of accuracy.

IL.7.A

STANDARD: Measure and compare quantities using appropriate units, instruments and methods.

IL.7.A.2a

> Calculate, compare and convert length, perimeter, area, weight/mass and volume within the customary and metric systems.

IL.7.B

STANDARD: Estimate measurements and determine acceptable levels of accuracy.

IL.7.B.2a

> Determine and communicate possible methods for estimating a given measure, selecting proper units in both customary and metric systems.

IL.7.B.2b

> Estimate conversions between measures within the customary and metric systems.

IL.7.C

STANDARD: Select and use appropriate technology, instruments and formulas to solve problems, interpret results and communicate findings.

IL.7.C.2a

> Describe relationships in a simple scale drawing.

IL.7.C.2b

> Construct or draw figures with given perimeters and areas.

IL.10.A

STANDARD: Organize, describe and make predictions from existing data.

IL.10.A.2a

> Organize and display data using pictures, tallies, tables, charts, bar graphs, line graphs, line plots and stem-and-leaf graphs.

IL.10.B

STANDARD: Formulate questions, design data collection methods, gather and analyze data and communicate findings.

IL.10.B.2a

> Formulate questions of interest and select methods to systematically collect data.

IL.10.B.2b

> Collect, organize and display data using tables, charts, bar graphs, line graphs, circle graphs, line plots and stem-and-leaf graphs.

IL.10.B.2d

> Interpret results or make relevant decisions based on the data gathered.

IL.11

GOAL: Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems.

IL.11.A

STANDARD: Know and apply the concepts, principles and processes of scientific inquiry.

IL.11.A.2a

> Formulate questions on a specific science topic and choose the steps needed to answer the questions.

IL.11.A.2b

> Collect data for investigations using scientific process skills including observing, estimating and measuring.

IL.11.A.2c

> Construct charts and visualizations to display data.

IL.11.A.2d

> Use data to produce reasonable explanations.

IL.11.A.2e

> Report and display the results of individual and group investigations.

IL.12

GOAL: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

IL.12.A

STANDARD: Know and apply concepts that explain how living things function, adapt and change.

IL.12.A.2a

> Describe simple life cycles of plants and animals and the similarities and differences in their offspring.

IL.12.B

STANDARD: Know and apply concepts that describe how living things interact with each other and with their environment.

IL.12.B.2a

> Describe relationships among various organisms in their environments (e.g., predator/prey, parasite/host, food chains and food webs).

IL.12.B.2b

> Identify physical features of plants and animals that help them live in different environments (e.g., specialized teeth for eating certain foods, thorns for protection, insulation for cold temperature).

IL.13

GOAL: Understand the relationships among science, technology and society in historical and contemporary contexts.

IL.13.A

STANDARD: Know and apply the accepted practices of science.

IL.13.A.2a

> Demonstrate ways to avoid injury when conducting science activities (e.g., wearing goggles, fire extinguisher use).

IL.13.A.2b

> Explain why similar investigations may not produce similar results.

IL.13.A.2c

> Explain why keeping accurate and detailed records is important.

IL.13.B

STANDARD: Know and apply concepts that describe the interaction between science, technology and society.

IL.13.B.2a

> Explain how technology is used in science for a variety of purposes (e.g., sample collection, storage and treatment; measurement; data collection, storage and retrieval; communication of information).

IL.13.B.2b

> Describe the effects on society of scientific and technological innovations (e.g., antibiotics, steam engine, digital computer).

IL.13.B.2c

> Identify and explain ways that science and technology influence the lives and careers of people.

**Instructor Notes**

Objectives

The goals of this lesson are to build upon prior skills and knowledge and to introduce additional skills and knowledge.

This is a two part Lesson covering life functions through use of plants. Due to the grand concepts being introduced and taught, the use of plants will simplify the concepts for later incorporation into all life forms. Students will be provided ample time in learning, practicing and applying learned targets. The first Lesson discusses plant parts, categories, characteristics and overview of life functions.

Assessment Activities

Assessments can encompass a range of activities including pencil/paper, projects, behavior/class participation, performance-based, homework, etc.  The most important aspect is that the rubric criteria and answer key must match the lesson objectives.  This includes ensuring that students receive enough practice to have a fair assessment. Activities are outlined below in the order they are intended to occur:

Pre-readings from *How it Works, The Environment*. Read pages 14 through 17. This activity is to introduce some background knowledge to students so they can connect their own experiences to the concepts.

Day One

Vocabulary review of terms from last lesson. The vocabulary concerning photosynthesis will pertain to this lesson.

FORMATIVE : Review of previous lesson. We will discuss concepts that are pertinent to photosynthesis.

Introduce new vocabulary and have students conduct their vocabulary tasks (they must complete 3 tasks by the end of lesson) A formal assessment will take place on day 3 and day 5.

Watch video on PBS.org about how trees make food.

FORMATIVE : Discuss video and relate to small plants and acquired knowledge.

SUMMATIVE: Setup Lab 1. Some students will setup a lab on Phototropism and other students will setup a lab on Geotropism.

FORMATIVE: Take home activity: photosynthesis paper manipulatives.

Day Two

FORMATIVE : Check Lab experiment and record in journal.

Reading: *Photosynthesis* pages 5 through 11. Connects photosynthesis and food chain.

Create and complete a cross-word puzzle.

FORMATIVE : Instruction on chemical process of photosynthesis. Check photosynthesis manipulatives worksheet. Introduce Light-Dependent, Light-Independent, Respiration, Phototropism and Geotropism.

Day Three

SUMMATIVE: Check Lab experiment and record in journal.

Reading: Pages 18 through 21.

FORMATIVE : Worksheet 1: Vocabulary

Instruction on food webs, connecting previously acquired knowledge.

Food web activities (forms A through B):

FORMATIVE : Model how to create a food web with the provided information and the diagram. Use Form A.

FORMATIVE : Provide guided instruction, where I explicitly provide instruction as the students conduct each step. Use Form B.

Day Four:

Check Lab experiment and record in journal.

Food web activities (forms C through D):

SUMMATIVE: Allow students to work in small groups to complete Form C.

SUMMATIVE: Have students complete a food web independently using form D.

Day Five:

SUMMATIVE: Check Lab experiment and record in journal. Conclude and complete Science Journal. Clean up lab.

FORMATIVE: Microscope activity: Have students operate a microscope to view a prepared slide of a leaf. They are looking for a stomata.

SUMMATIVE: Cummulative Exam & Vocabulary test.

Rubric

| **Rubric** | | | | |
| --- | --- | --- | --- | --- |
|  | **Advanced**(4.000 pts) | **Proficient**(3.000 pts) | **Developing**(2.000 pts) | **Beginner**(1.000 pt) |
| Lab 3A/3B: Science Journal(1.000, 50%) | Answers What, Why and How in Science Journal accurately. Uses more than 3 vocabulary terms correctly. | Answers What, Why and How in Science Journal accurately. Uses 3 vocabulary terms correctly. | Attempts to answer What, Why and How in Science Journal, some inaccuracy or ambiguous responses. Less than 3 vocabulary terms used correctly. | No attempt to answer or all answers in accurate in consulting What, Why and How in Science Journal. No, or all inaccurately used vocabulary terms |
| Lab 3A/3B:Data(1.000, 50%) | Uses technology to illustrate collected data. Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled. | Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled. | Accurate representation of the data in written form, but no graphs or tables are presented. | Data are not shown OR are inaccurate. |
| Lab 3A/3B: Procedures | Procedures are listed in clear steps. Each step is numbered and is a complete sentence. Conducted experiment according to procedures. | Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences. Conducted experiment according to procedures. | Procedures are listed but are not in a logical order or are difficult to follow. Some flaws in following consistent procedure. | Procedures do not accurately list the steps of the experiment. |
| Lab 3A/3B: Safety Protocols: | Student followed safety procedures during lab. Corrected or reminded others of safety measures. | Student followed safety procedures during lab, would correct self. | Student had to be reminded about safety in the lab. Followed procedures most of the time. | Student failed to conduct safety or consistently violated safety procedures. |
| Vocabulary Flashcards | Not Applicable | Not Applicable | Not Applicable | One point granted if flashcards completed. No points are granted if flashcards are incomplete or not attempted. |
| Vocabulary Puzzle | Not Applicable | Not Applicable | Two points granted if puzzle is completed and student completes another classmates puzzle. | One point granted if puzzle is completed. No points are granted if puzzle is incomplete or not attempted. |
| Participation | Participated each day of lesson. Illustrated evidence of completing readings and deriving comprehension from readings. | Participated for 80% of the days of lesson. Illustrated that they completed and understood at least 4 of the readings. | Participated 60% of the days of lesson. Illustrated that they completed and understood at least 3 of the readings. | Participated less than 60% of the days of lesson and/or did not complete or seek clarity in readings. |
| Cummulative Exam | Scored 95-100% correct. | Scored 94-89 correct. | Scored 88-79 correct. | Scored 78 or less correct. |
| Vocabulary Quiz | Scored 95-100% correct. | Scored 94-89 correct. | Scored 88-79 correct. | Scored 78 or less correct. |
| Vocabulary Exam | Scored 95-100% correct. | Scored 94-89 correct. | Scored 88-79 correct. | Scored 78 or less correct. |
| Activity One: Photosynthesis | Student attempted activity and all five items were in appropriate position. | Student attempted activity and only one item was not in appropriate position. | Student attempted activity and only two items were not in appropriate position. | No attempt or three or more items were not in appropriate position. |
| Food Webs C | Student properly identified position in food chain of each animal described in ecosystem. Diagram was complete and clearly depicted the positions of each living being within food web. | Student properly identified 80% of living beings at appropriate position based on description. Diagram attempted with 80% accuracy. | Student properly identified 70% of living beings at appropriate position based on description. Diagram was attempted with 70% accuracy. | No Attempt or less than 70% accuracy of identification and diagram. |
| Food Webs D | Student properly identified position in food chain of each animal described in ecosystem. Diagram was complete and clearly depicted the positions of each living being within food web. | Student properly identified 80% of living beings at appropriate position based on description. Diagram attempted with 80% accuracy. | Student properly identified 70% of living beings at appropriate position based on description. Diagram was attempted with 70% accuracy. | No Attempt or less than 70% accuracy of identification and diagram. |
|  |  |  |  |  |

Instructional Activities

Day One

Vocabulary review of terms from last lesson. The vocabulary concerning photosynthesis will pertain to this lesson. *Use projector or have students write words on board and call on another student to answer.*

Review of previous lesson. We will discuss concepts that are pertinent to photosynthesis. *Use questions in instructional outline and a random way to call on students to answer.*

Introduce new vocabulary and have students conduct their vocabulary tasks (they must complete 3 tasks by the end of lesson) A formal assessment will take place on day 3 and day 5. *Students may work in pairs, use computers if available and can use art supply to make flashcards.*

Watch video on PBS.org about how trees make food. *Have groups demonstrate how the tree makes food using components of the process cut out of large cardstock and arrange in correct order. Similar to photosynthesis manipulatives worksheet.*

*Discuss* video and relate to small plants and acquired knowledge.

Setup Lab 1. Some students will setup a lab on Phototropism and other students will setup a lab on Geotropism. *A hands-on approach to introduce concepts through experiment. Students will have to find out what will actually happen by experiment.*

Take home activity: photosynthesis *paper manipulatives*.

Day Two

Check Lab experiment and record in journal. *Provide feedback to student. Offer comments that require student to self-reflect such as “How can you explain this using your new vocabulary?”*

*Reading*: *Photosynthesis* pages 5 through 11. Connects photosynthesis and food chain.

Create and complete a cross-word puzzle. *Use technology if available to create puzzles*

*Verbal Instruction* on chemical process of photosynthesis.

Check photosynthesis manipulatives worksheet. *Tell student which elements are incorrect and allow student another chance to place in correct order.*

*Verbal Instruction have students offer explanations based on the results of experiments thus far.*Introduce Light-Dependent, Light-Independent, Respiration, Phototropism and Geotropism.

Day Three

Check Lab experiment and record in journal. *Provide feedback to student. Offer comments that require student to self-reflect such as “How can you explain this using your new vocabulary?”*

*Reading*: Pages 18 through 21.

*Paper-pen activity*: Vocabulary Quiz

*Verbal Instruction, have students contribute ideas derived from reading to add to instruction.*Instruction on food webs, connecting previously acquired knowledge.

*Pencil-Paper activity, visual*: Food web activities (forms A through B):

*Model* how to create a food web with the provided information and the diagram. Use Form A.

Provide *guided instruction*, where I explicitly provide instruction as the students conduct each step. Use Form B.

Day Four:

Check Lab experiment and record in journal. *Provide feedback to student. Offer comments that require student to self-reflect such as “How can you explain this using your new vocabulary?”*

Food web activities (forms C through D):

Allow students to work in *small groups* to complete Form C.

Have students complete a food web *independently* using form D.

Day Five:

Check Lab experiment and record in journal. Conclude and complete Science Journal. Clean up lab. *Provide feedback to student. Offer comments that require student to self-reflect such as “How can you explain this using your new vocabulary?”*

*Hands on activity* - *visual*:Microscope activity: Have students operate a microscope to view a prepared slide of a leaf. They are looking for a stomata. Reading about a stomata is different than seeing a stomata!

*Pen and Paper assessment:* Cummulative Exam & Vocabulary test.

Reading Across the Curriculum

Describe how reading strategies/assessments are infused within this lesson.

Students will utilize some skills acquired or learned in Language Arts/Writing, and Mathematics.

The students will conduct the lab activity using a format or process learned called the 5-Step Scientific Method. This method is used widely as an educational tool and offers the practice of using a consistent, thorough procedure to conduct research. Students will use skills from writing, speaking, mathematics, problem-solving and what-of scenarios.

There are many books that discuss why it is important to know the processes learned. Some motivations are learning how to grow plants, applying to larger concepts in the future, horticulture, landscaping, home care and many more reasons for knowing.

Students are listening to the teacher model fluency and comprehension during the readings. The pre-reading will offer students experience with deriving evidence from readings and applying to concepts by making hypothesis.

During Extensions of activities, students are able to use their home environment to explore a familiar environment.

Strategies for English Language Learners

-The activity will be modeled to students to put instructions into context.

-Visual aids are used throughout activity (PowerPoint, dry erase board, handouts with pictures and illustrations and physical manipulatives).

-Allow additional time to complete assignment.

-Obtain a translator if necessary.

-Documents and worksheets made available in appropriate language for assistance at home (by non-English speakers) and for student’s benefit.

-Content on Scientific Method is available through PBS.org in Spanish.

-Books in additional languages on topics will be made available through library resources.

-Explicit instruction provided for complimentary tasks (such as use of technology). Photos or visual samples provided.

-Pair students with similar languages yet different levels of functioning to assist the student with less understanding of English. Peer-assisted.

Adaptation for Exceptional Students

-Emerging learners will be placed with students who illustrate high competency of task. They will be grouped into a small group and will be provided additional assistance. All students will be allowed to revise or complete tasks at home. Additional reading is available. Study techniques for vocabulary are utilized (hands-on: flashcards; in context: worksheets; word parts: latin derivatives of vocabulary provided)

-Advanced learners can choose to work independently on 2 labs and can create a survey of their own choosing to rehearse tasks.

-Advanced learners can also choose to complete a modified assignment in lieu of other assignments. These assignments will ask student to utilized skillsets that are more developed such as using technology for demonstrations and charts.

-For students with vision and/hearing difficulties, the teacher will allow students to move to another place in the classroom where he/she can see the modeling and class activities best. Large printed handouts will be available. Instruction is delivered in multiple methods; verbal, visual, modeling and hands-on.

-Utilization of Hammond Environmental Center (free to public to tour). Have students visit during feeding time and record observations.

-Higher functioning level students will be offerred opportunity to Peer-tutor another student, under supervision of teacher.

Word Bank

1. Carbon Dioxide; the gas humans and most animals expel when they are breathing. Inhale oxygen and exhale carbon dioxide. The change occurs from oxygen to carbon dioxide when carbon (a waste product) attached to the oxygen to be removed from our body.
2. Water; a compound necessary for the process of photosynthesis. An important ingredient that combines with carbon dioxide in the presence of light and forms new products, oxygen and a food molecule.
3. Light Energy; light or sunlight is energy that we will explore more in later lessons. Light is necessary for the process of photosynthesis to occur.
4. Chemical Energy; another scientific way to say food. Food is ingested in its whole form such as an apple and our bodies breakdown this food into chemicals that are then used as energy.
5. Chlorophyll; a miniature pigment or color in plants and some bacteria whose primary duty is to absorb light to fuel the process of photosynthesis.
6. Chloroplasts; a organelle that is the site or location of photosynthesis. Think of as a power house or battery.
7. Stomata; a tiny opening in the plant that releases abundant water or absorbs water.
8. Light-Dependent Reactions; a process that needs light to occur, such as photosynthesis.
9. Light-Independent Reactions; processes that do not need light to occur.
10. Respiration; the exchange of oxygen for carbon dioxide. Think of oxygen as currency and you use it to purchase a carbon. That product cost the seller a bit (the oxygen).
11. By-product or Waste (in chemical reaction); the resulting product. In photosynthesis the by-product is oxygen because it is not the intended component, food it. Oxygen is just a by-stander carrying the carbon to the baker.
12. Phototropism; the movement towards light.
13. Geotropism; the movement guided by the rules of gravity.
14. Primary Producers; plants, fungi or any other source that makes all it’s food.
15. Primary Consumers; animals that are often not prey to others and consume other food sources.
16. Omnivores; eat plants and animals.
17. Carnivores; eat animals.
18. Herbivores; eat plants.
19. Autotrouphs; make own food.

Equipment and Materials

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| --- | --- |
| Day 1 | Pre-reading Book: *Photosynthsis* and *How It Works, The Environment*  Vocabulary Flashcards – 30 copies  Vocabulary Puzzle – 30 copies  Lab 3A – 15 copies  Lab 3B – 15 copies  My Science Journal – 30 copies  Card Stock or index cards  Digital projector or some other means to project or show diagrams and photos on master sheet  Computers with internet access  Based on needs: Blank sheets of paper or large print activities  Master sheets for Activity 1, Vocabulary Flashcards, Vocabulary Puzzle, Labs, Instructional Outline, Vocabulary from Lesson 1 of Unit 4.  Scissors, small boxes (like shoeboxes, begin collecting at beginning of school-year)  Optional: Webcams for video logs of lab  Area with windows with ample sunlight |
| Day 2 | Books: *Photosynthsis* and *How It Works, The Environment*  Digital projector or some other means to project or show diagrams and photos on master sheet  Optional: Webcams for video logs of lab  Area with windows with ample sunlight  Microscope available (if time allows we will view a leaf)  Prepared slides (10)  Digital projector or some other means to project or show diagrams and photos on master sheet |
| Day 3 | Books: *Photosynthsis* and *How It Works, The Environment*  Digital projector or some other means to project or show diagrams and photos on master sheet  Vocabulary Quiz – 30 copies  Food Webs Form A – 30 copies  Food Webs Form B – 30 copies  Optional: Webcams for video logs of lab  Area with windows with ample sunlight  Instructional Outline, Master sheets for Food Webs  Microscope available (if time allows we will view a leaf)  Prepared slides (10) |
| Day 4 | Digital projector or some other means to project or show diagrams and photos on master sheet  Books: *Photosynthsis* and *How It Works, The Environment*  Food Webs Form C – 30 copies  Food Webs Form D – 30 copies  Instructional Outline, Master sheets for Food Webs  Microscope available (if time allows we will view a leaf)  Prepared slides (10) |
| Day 5 | Books: *Photosynthsis* and *How It Works, The Environment*  Digital projector or some other means to project or show diagrams and photos on master sheet  Cumulative exam – 30 copies  Instructional Outline, Master sheets for Food Webs  Microscope available (if time allows we will view a leaf)  Prepared slides (10) |

Safety & Disposal Concerns

Be aware of food allergies before administering or bringing in foreign materials for lab activities.

Proper disposal of biodegradable items in proper bin. Recycle materials or prepare used materials for reuse.

General lab safety to be followed and classroom rules to be followed and enforced.

**Master Documents**

Student Handouts

Listed and attached below are handouts that will be used by the students:

* Student Handout 1: Vocabulary Flashcards
* Student Handout 2: Vocabulary Puzzle
* Student Handout 3: Lab 3A: Phototropism & Lab 3B Geotropism
* Student Handout 4: Photosynthesis manipulatives
* Student Handout 5: Vocabulary Quiz
* Student Handout 6: Food Webs Form A
* Student Handout 7: Food Webs Form B
* Student Handout 8: Food Webs Form C
* Student Handout 9: Food Webs Form D
* Vocabulary Exam and Cummulative Exam

Teacher Documents

Listed and attached below are handouts that will be used by the teacher:

* Teacher Handout 1: Activity 1: Photosynthesis Manipulatives
* Teacher Handout 2: Vocabulary, Flashcards
* Teacher Handout 3: Vocabulary Quiz
* Teacher Handout 4: Vocabulary Exam
* Teacher Handout 5: Labs 3A/ & 3B
* Teacher Handout 6: Master Sheet for Food web Activities (Forms A, B, C & D)
* Instructional Outline

**Resources**

References Cited

Allaby, Michael. How It Works. The Environment. (1996). Horus Editions Limited. London.

Nunn, Laura Silverstein Silverstein, Alvin Silverstein, Virginia. Photosynthesis. (1998). Twenty-First Century Books. Brookfield, Connecticut.

Resources

PBS.org activity:

<http://www.pbs.org/wgbh/nova/methuselah/phot_atomic.html>

PBS.org Video: How trees make Food

<http://video.pbs.org/video/2204230219/>

Photosynthesis is the process by which living things turn light energy into chemical energy. Most commonly, the term refers to a process by which sunlight, carbon dioxide, and water are converted into sugar; its name comes from Latin words for "formation in light." All human food energy, and the food energy for many other living things, is either directly or indirectly derived from this process. When an organism eats plants or other creatures that feed on plants, that organism is consuming energy that was generated through photosynthesis. Photosynthesis occurs in plants, algae, and some bacteria, a group of organisms known as*photoautotrophs*.

Photosynthesis occurs differently, depending on what kind of organism is involved. In plants, sunlight stimulates a pigment called chlorophyll, which is located in structures called chloroplasts. In the chloroplasts, sunlight reacts with carbon dioxide--which the plant takes in through microscopic holes in its leaves (stomata)--and with water that the plant absorbs through its roots. During a series of light-dependent and light-independent reactions, water molecules are broken down into hydrogen and oxygen. The hydrogen combines with carbon dioxide to produce glucose, a simple sugar that is used as a building block for starch and other complex carbohydrates. The oxygen is later released into the atmosphere during the processes of respiration and transpiration; in this manner, photosynthesis is responsible for renewing Earth's oxygen supply.

The process is biochemically similar in algae and bacteria, but different pigments are involved. Algae are much like plants, in that they have chlorophyll and chloroplasts. However, they also employ a wide range of accessory pigments in photosynthesis, which is why algae come in diverse colors such as red and blue-green. Algae produce oxygen as a result of photosynthesis as well. Photosynthetic bacteria, on the other hand, do not have chloroplasts or any similar cellular structures. Photosynthesis relies on a variety of pigments called bacteriochlorophylls and takes place within the single-celled organism. Photosynthetic bacteria do not produce oxygen. The bluish cyanobacteria contain both chlorophyll and bacteriochlorophyll, and their photosynthetic process is biochemically closer to that of plants, though they still do not produce oxygen.

It took hundreds of years for scientists to piece together the details of the photosynthetic process. Historically, research on photosynthesis has been closely linked to knowledge of plant growth and structure; a number of basic insights were needed before work on photosynthesis could begin. In the seventeenth century, two scientists showed that plants require air and water to grow: Flemish chemist and physician Johannes (Jan) Baptista van Helmont (1577-1644) and English chemist and physiologist Stephen Hales (1677-1761). In the eighteenth century, chemists began to identify the individual gases involved in combustion, respiration, and photosynthesis. English chemist Joseph Priestley (1733-1804) demonstrated that green plants can replenish stale, or oxygen-poor, air, making that air capable of supporting combustion and respiration.

Inspired by Priestley's research, Dutch physiologist and botanist Jan Ingenhousz (1730-1799) found that only the green parts of plants can revitalize stale air--that is, only these parts can take in carbon dioxide and release oxygen--and that they do so only in the presence of sunlight. Ingehousz's observations were the first indication of light's role in the photosynthetic process. Scientists knew that plants needed sunlight, but Ingenhousz showed that plants specifically needed the Sun's light, rather than its heat. Taken alone, the heat of sunlight was not sufficient to keep the plants alive.

Nineteenth-century photosynthesis research centered on understanding the chemical processes by which carbon is fixed in carbohydrates. In the late nineteenth century, German botanist Julius von Sachs (1832-1897) suggested that starch is a product of carbon dioxide. In 1865, he suggested that chlorophyll catalyzes photosynthetic reactions in the presence of light, and he discovered the chlorophyll-containing chloroplasts in plant cells. In the late nineteenth century, German physiologist Theodor Wilhelm Engelmann (1843-1909) showed that light-dependent reactions, which capture solar energy and convert it into chemical energy, occur within the chloroplasts and respond only to the red and blue spectrum of natural light.

It was not until the twentieth century, however, that scientists began to understand the complex biochemistry of photosynthesis. German chemist Richard Willstätter recognized that land plants contained two major types of chlorophyll: blue-green, or "a" type, and yellow-green, or "b" type. He received the 1915 Nobel prize in chemistry for his research into plant pigments. In 1940, a Canadian-born American biochemist named Martin David Kamen (1913-2002) isolated carbon-14, a radioactive isotope of carbon which would later allow for more detailed studies of photosynthesis. Kamen went on to use another isotope (oxygen-18) to trace oxygen's role in the photosynthetic process. He thus confirmed that the oxygen created during photosynthesis comes only from the water molecules that take part in the process. German physiologist Otto Warburg (1883-1970) found that, under suitable conditions, the efficiency of the photosynthetic process can approach 100%, meaning that the amount of light energy the organism takes in is converted to nearly the same amount of chemical energy.

American chemist Melvin Calvin (1911-1997) used carbon-14 to trace carbon's path through the entire photosynthetic process. In the mid-twentieth century, he confirmed that the light-dependent reactions involving chlorophyll instantly capture the Sun's energy. Calvin then studied the light-independent (or "dark") reactions, which can take place in the absence of sunlight; Calvin found that carbohydrate molecules begin to form at this stage in the photosynthetic process. Working with green algae cells, Calvin interrupted the photosynthetic process at different stages and used a laboratory technique called paper chromatography to analyze the cells and the chemicals that had been produced at that stage. He identified at least ten intermediate products that had been created within a few seconds. This series of reactions is now called the Calvin cycle. In 1961, Calvin received the Nobel prize in chemistry for his work on photosynthesis.

Even though the basic process is now well understood, photosynthesis continues to hold surprises. In 1998, scientists at Arizona State University announced that they had created an artificial photosynthetic energy system. The cell-like machine used light to power the synthesis of adenosine triphosphate (ATP), a nucleotide that carries chemical energy in all organisms. In 2005, deep-sea researchers discovered photosynthetic bacteria living more than 2000 meters below the sea. These bacteria are far beyond the reach of sunlight, and their photosynthetic processes rely on heat from hydrothermal vents.

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<http://www.nhptv.org/natureworks/nwepphotosynthesis.htm>

Plants use a process called**photosynthesis**to make food. During photosynthesis, plants trap light energy with their leaves. Plants use the energy of the sun to change water and carbon dioxide into a sugar called **glucose**. Glucose is used by plants for energy and to make other substances like **cellulose**and **starch**. Cellulose is used in building cell walls. Starch is stored in seeds and other plant parts as a food source. That's why some foods that we eat, like rice and grains, are packed with starch!

Most plants contain a special colored chemical or**pigment** called**chlorophyll** that is used in photosynthesis. Chlorophyll is what absorbs the sun's energy and turns it into chemical energy. Not all the light energy from the sun is absorbed.   
  
[[](javascript:popImage('/natureworks/graphics/mapleleaf.jpg','maple%20leaf'))](javascript:popImage('/natureworks/graphics/mapleleaf.jpg','maple%20leaf'))Sunlight has many different colors in it. Chlorophyll usually absorbs red and blue light from the sun and reflects green light. It's the green light reflecting  that makes some leaves look green! In the fall, some plants stop producing chlorophyll and we see leaves change color. With the chlorophyll gone, the green light is not being reflected anymore!

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