

# Photosynthesis

## 5E Lesson

The 5E model is a scientifically proven method to improve student engagement and learning in your classroom

- ✓ Engagement
- ✓ Exploration
- ✓ Explanation
- ✓ Elaborate
- ✓ Evaluate



# Complete Teacher Instructions

## Photosynthesis 5E Lesson

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| Grades 9-12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Static Electricity | Ongoing |
| <b>Lesson Objective:</b><br>Students will learn: <ul style="list-style-type: none"> <li>Why photosynthesis is essential to life</li> <li>How photosynthesis works               <ul style="list-style-type: none"> <li>→ The light and dark reactions</li> </ul> </li> <li>About chloroplasts and pigments</li> <li>How photosynthesis and cellular respiration connects</li> <li>About the protein RuBisCo and it's importance</li> </ul>                                                                                                                                                                                                                                                                                                                                             |                    |         |
| <b>Possible Student Misconceptions:</b> <ul style="list-style-type: none"> <li>Plants don't undergo cellular respiration</li> <li>Plants use light as a food source</li> <li>There is only 1 color pigment</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |         |
| <b>Materials:</b> <ul style="list-style-type: none"> <li>1 device (smartphone, Chromebook, laptop, tablet, or computer) p</li> <li>A means of projecting a PowerPoint presentation</li> <li>Internet access</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |         |
| <b>Teacher Notes:</b> <ul style="list-style-type: none"> <li>➢ All videos can be accessed directly from the PowerPoint. To retrieve icon while in slideshow mode and it will automatically open for you reason, right-click on the image and click <b>Edit Hyperlink</b> or some</li> <li>➢ I've created a video walkthrough if needed. It can be accessed here <a href="https://youtu.be/oCIKIP9SaDQ">https://youtu.be/oCIKIP9SaDQ</a></li> <li>➢ I don't believe in long lessons. If you feel your students are losing Stop the PowerPoint and give them a 5-minute break. If you'd like recommend my video collection here - <a href="http://www.teachwithfergy.com">http://www.teachwithfergy.com</a> are tons of brain-break videos to choose from all grouped by cate</li> </ul> |                    |         |

| Photosynthesis – 5E Lesson                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                               |
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| <b>Engagement Phase</b> <ul style="list-style-type: none"> <li>Start by having your students write down what they already know about photosynthesis</li> <li>Next, show them "The Photosynthesis Song" which can be found here - <a href="http://www.teachwithfergy.com/the-photosynthesis-song/">http://www.teachwithfergy.com/the-photosynthesis-song/</a></li> <li>It's a fun song that should lighten the mood and introduce them to the topic</li> <li>Following the video, have them revise what they wrote down previously</li> <li>Lastly, group your students into pairs and have each pair create a new "master" list of the things they know about photosynthesis</li> </ul> <p>Teacher Note: If the link doesn't work for some reason, go to <a href="http://www.youtube.com">www.youtube.com</a> and type in "the Photosynthesis Song" - Mr. Edmonds" in the search engine.</p> | Duration 15 - 20 min<br><br>Teacher Role – Facilitate learning and guide student understanding<br><br><b>Goals</b> <ul style="list-style-type: none"> <li>Connect student's experiences</li> <li>Create interest</li> <li>Ask questions</li> <li>Understand the objective of the lesson</li> </ul>                            |
| <b>Exploration Phase</b><br><b>Exploration – Lab Station Activity</b> <ul style="list-style-type: none"> <li>In groups of 2-3, have your students complete <a href="#">Exploration – Lab Station Activity</a>. Once they're done, they will submit their passport to you.</li> </ul> <p>Teacher Notes:</p> <ul style="list-style-type: none"> <li>The complete instructions for my Lab Station activity can be found in the <a href="#">START HERE – Instructions</a> file.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                       | Duration: 1 hour<br><br>Teacher Role – Facilitate learning and guide student understanding<br><br><b>Goals</b> <ul style="list-style-type: none"> <li>Students receive experience with the</li> <li>Students use and creative thinking s</li> <li>Students make observations, record results, and make connections</li> </ul> |
| <b>Explanation Phase</b><br><b>Explanation – Photosynthesis Lesson</b> <ul style="list-style-type: none"> <li>The lesson is found in the folder – "Explanation – Lesson"</li> <li>This lesson is designed to be completed over two - three days</li> <li>There are many embedded videos and plenty of opportunity to engage, interact and check for your students' understanding throughout the lesson</li> <li>The lesson covers the following topics:               <ul style="list-style-type: none"> <li>Photosynthesis overview</li> <li>Equation</li> <li>Chloroplast &amp; Pigments</li> <li>Photosynthesis &amp; Cellular Respiration connection</li> <li>The Light Reaction</li> <li>The Light Independent Reaction/Calvin Cycle</li> <li>Essential RuBisCO</li> </ul> </li> </ul>                                                                                                  | Duration: 2-4 hours<br><br>Teacher Role – Explain concepts by presenting material found in the presentation.                                                                                                                                                                                                                  |

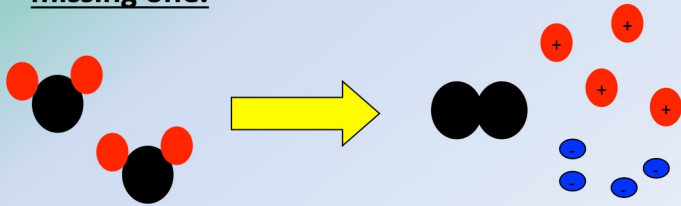
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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Teacher Notes:</b> <ul style="list-style-type: none"> <li>All videos can be accessed directly from the PowerPoint. To retrieve them, click on the video icon while in slideshow mode and it will automatically open for you. If they don't open, right-click the image and select Edit Hyperlink or something similar.</li> <li>I've created a video walkthrough if needed. It can be accessed here - <a href="https://youtu.be/oCIKIP9SaDQ">https://youtu.be/oCIKIP9SaDQ</a></li> <li>I have also enclosed a .PDF version of both the teacher and student versions</li> </ul>                                                                               | <b>Goals</b> <ul style="list-style-type: none"> <li>Students develop understanding of the content</li> <li>Observations and experiences are discussed and critiqued</li> <li>Students develop vocabulary</li> <li>Students are able to connect the content presented to previous experiences</li> </ul> |
| <b>Elaborate Phase</b><br><b>There are TWO Elaborate activities</b><br><b>1) Scavenger Hunt Activity</b><br>Your students will complete – <a href="#">Elaborate - Scavenger Hunt Activity</a> . This activity will require your students to move beyond what was covered directly in the lesson and allow them to demonstrate why what they're learning is so applicable and important.                                                                                                                                                                                                                                                                         | Duration: 1 hour<br><br>Teacher Role – Facilitate learning and keep students focused<br><br><b>Goal</b> <ul style="list-style-type: none"> <li>Students use their newly obtained knowledge to propose solutions and extend their learning to new situations</li> </ul>                                  |
| <b>Teacher Notes:</b> <ul style="list-style-type: none"> <li>Students will work in groups of two or three</li> <li>Each group will only require a single device (smartphone, tablet, Chromebook, laptop, etc.).</li> </ul> <b>2) RuBisCO Reading</b> <ul style="list-style-type: none"> <li>Your students will complete – <a href="#">Elaborate – RuBisCO Reading</a></li> <li>This activity will require your students to move beyond what was covered directly in the lesson and allow them to develop a deeper understanding of the topic and it's applicability</li> </ul> <p>Teacher Notes:</p> <p>Students will work individually or in groups of two</p> |                                                                                                                                                                                                                                                                                                         |
| <b>Evaluate Phase</b><br><b>Photosynthesis quiz</b><br>Have your students complete - <a href="#">Evaluate – Photosynthesis – Quiz</a><br>All quiz questions will come from the lesson                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Duration: 30 min.<br><br>Teacher Role – Distribute and collect evaluation<br><br><b>Goal</b> <ul style="list-style-type: none"> <li>Students are given the opportunity to demonstrate their understanding and evaluate their own progress</li> </ul>                                                    |
| <b>Teacher Notes:</b> <ul style="list-style-type: none"> <li>It's sometimes best to have the students peer evaluate</li> <li>Placing students in small groups and having them exchange papers to mark will accomplish two things</li> </ul> <ol style="list-style-type: none"> <li>Provide immediate feedback on the quiz they just completed</li> <li>Significantly reduce your marking time</li> </ol> <ul style="list-style-type: none"> <li>➢ Peer evaluation is not needed, only suggested when appropriate</li> </ul>                                                                                                                                     |                                                                                                                                                                                                                                                                                                         |

Each phase is clearly described

# A Complete Lesson

## Photosystem II

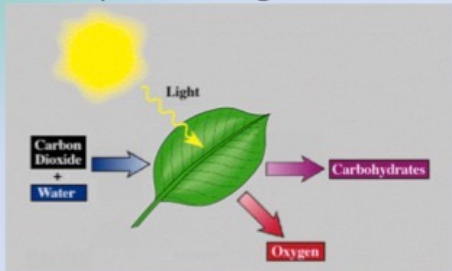
- The P680 Chlorophyll *a* molecule is now oxidized (missing an electron)- how does it get it back?
- Water is split into 2 protons, 1/2 O<sub>2</sub> and 2 electrons - these electrons replace the missing one.



← Information filled lessons  
 Student copies with blanks  
 Videos embedded right into  
 your slideshow

## Photosynthesis

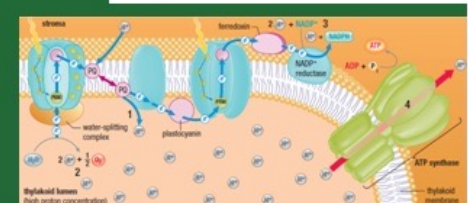
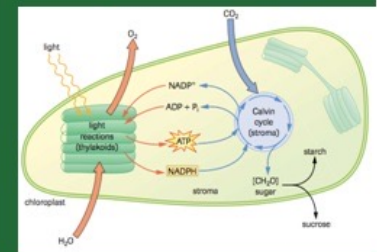
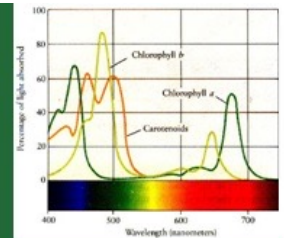
- \_\_\_\_\_ 
- See how videos are embedded into your lesson
- Occurs in the leaves of plants in organelles called chloroplasts.



carbon dioxide + water  $\xrightarrow{\text{light energy}}$  sugar + oxygen

## Photosynthesis

- Photosynthesis overview
- Equation
- Chloroplast & Pigments
- Photosynthesis & Cellular Respiration connection
- The Light Reaction
- The Light Independent Reaction/Calvin Cycle
- Essential RuBisCO



# Includes my Interactive and Engaging Science Reading and Lab Station Activities

## Photosynthesis Lab Station Activity



7 Lab Station Activities to get your kids out of their seats and engaged in their learning

## RuBisCo

## Scientific Reading Comprehension Article



Improve your students **Scientific Literacy** and **Analysis Skills**, use as an **Emergency Substitute Plan** or create **Applicability** in your classroom

# Get away from tired practices and unengaged students



# Provide a Scientifically-Proven means of instruction



# Incorporate Technology and Increase Collaboration

