# Unit 6 - Photosynthesis and Cellular Respiration

**MCAS Frameworks:** This unit addresses the following MA State Frameworks in Biology:

**2.4** Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the

 interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms.

**2.5** Explain the important role that ATP serves in metabolism.

**SIS1.** Make observations, raise questions, and formulate hypotheses.

**SIS2.** Design and conduct scientific investigations.

**SIS3.** Analyze and interpret results of scientific investigations.

**SIS4.** Communicate and apply the results of scientific investigations.

**Big Ideas**

1. The transfer of energy studied on an ecological level can be understood on a molecular level.
2. Energy transfer from plants to animals can be interpreted as a series of chemical reactions.

**Essential Questions**

1. How are the interrelated reactions of photosynthesis and cellular respiration related to energy flow through an ecosystem?

Unit 6 - Photosynthesis and Cellular Respiration

**Text Reading: Chapters 8 and 9**

**Objectives***:**Upon completion of this unit, you should be able to:*

***Topic 1: Energy origins (8-1)***

1. Compare and contrast heterotrophs and autotrophs (specifically where each gets its food).
2. Draw and describe the three parts of an ATP molecule.
3. Use the analogy of a battery to explain how energy is stored in and released from ATP.
4. Compare the amounts of energy stored by ATP and glucose. Which compound is used by the cell as an immediate source of energy?

***Topic 2: Photosynthesis overview (8-2)***

1. Explain the experiments of van Helmont, Priestley, and Ingenhousz and what they showed about the way plants grow.
2. State and *explain* the chemical equation that summarizes photosynthesis.
3. Define pigment and chlorophyll.
4. Describe the roles of pigments, chlorophyll and light in photosynthesis.

***Topic 3: Photosynthesis details (8-3)***

1. Draw and label a diagram of the chloroplast, including the location and structure of the stroma, grana, thylakoids, and photosystems.
2. Explain the job of an electron carrier, specifically mention NADP+.
3. Draw and label a simple diagram of the process of photosynthesis, labeling inputs (what gets used) and outputs (what gets produced) at each stage.
4. Identify the factors affecting the rate of photosynthesis.

***Topic 4: Cellular Respiration (9-1, 9-2)***

1. State and explain the chemical equation that summarizes cellular respiration.
2. Draw and label a diagram of the mitochondrion.
3. Draw and label a simple diagram of the process of cellular respiration, labeling inputs and outputs at each stage and total energy molecules created.
4. Describe the two main types of anaerobic respiration (fermentation), including under what conditions each occurs.
5. Identify the three pathways the body uses to release energy during exercise.
6. Compare and contrast photosynthesis and cellular respiration.

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| **Key Terms/Concepts:** |
| Photosynthesis | Cellular respiration |
| Autotroph | Glycolysis |
| Heterotroph | Mitochondrion |
| Adenosine triphosphate (ATP) | Pyruvic acid (pyruvate) |
| Adenosine diphosphate (ADP) | Aerobic |
| Autotroph | Anaerobic |
| Van Helmont | Acetyl-CoA |
| Priestley | Electron transport chain (respiration) |
| Jan Ingenhousz | NAD+ |
| Pigment | NADH |
| Photosynthesis | FAD2+ |
| Chlorophyll | FADH2 |
| Chloroplast | Krebs cycle |
| Thylakoid | Alcoholic fermentation |
| Granum | Lactic acid fermentation |
| Stroma |  |
| Photosystem |  |
| Electron carrier |  |
| NADP+ | Photosystem I |
| NADPH | Electron Transport Chain (photosynthesis) |
| Light-dependent reactions | Calvin Cycle |
| Photosystem II | Light-independent reactions |

**Assessment Evidence**

Project: Inquiry based laboratory: Photosynthesis

Lab: Clothespin Olympics (anaerobic respiration)

Product: Written lab report

Assessment: Unit quiz

Assessment: Unit test

Observation: Teacher observation and feedback

**Learning Plan Period 5**

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| **Day** | **In Class Activity** | **Homework** |
| Thur 1/26A day | Review Mid year exam | Objectives 1-5 |
| Fri 1/27B day | No class |  |
| Mon 1/30C day | Review Autotrophs/HeterotrophsATP Structure |  |
| Tues 1/31D day | Leaf StructureStart Light Dependent Reaction | Objectives 6-10 |
| Wed 2/1E day | Light Dependent Reaction | Obj 11-13 |
| Thur 2/2F day | Calvin Cycle | Obj 14-16 |
| Fri 2/3A day | Photosynthesis Lab | Finish lab |
| Mon 2/4B day | No class |  |
| Tue 2/5C day | Discuss Photosynthesis LabC4 and CAM plants |  |
| Wed 2/6D day | Factors Affecting PhotosynthesisChemosynthesis | Obj 17-20 |
| Thur 2/7E day | MitochondriaIntro to Cell Respiration | Obj 21-22 |
| Fri 2/8F day | Glycolysis and Fermentation | Obj 23-26 |
| Mon 2/11A day | Krebs CycleElectron Transport Chain | Obj 27-31 |
| Tue 2/12B day | No class |  |
| Wed 2/13C day | Relationship between Photosynthesis and Cell Resp.Exercise and Cell Respiration |  |
| Thur 2/14D day | Review |  |
| Fri 2/15E day | Unit exam |  |

**Assessment Evidence**

Project: Inquiry based laboratory: Photosynthesis

Lab: Clothespin Olympics (anaerobic respiration)

Product: Written lab report

Assessment: Unit quiz

Assessment: Unit test

Observation: Teacher observation and feedback

**Learning Plan Period 6**

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| **Day** | **In Class Activity** | **Homework** |
| Thur 1/26A day | No class |  |
| Fri 1/27B day | Review Mid year exam | Objectives 1-5 |
| Mon 1/30C day | Review Autotrophs/HeterotrophsATP Structure | Objectives 6-10 |
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| Wed 2/1E day | Light Dependent Reaction |  |
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| Tue 2/12B day | Krebs CycleElectron Transport Chain | Obj 27-31 |
| Wed 2/13C day | Relationship between Photosynthesis and Cell Resp.Exercise and Cell Respiration | Study |
| Thur 2/14D day | Review | Study |
| Fri 2/15E day | Unit exam |  |