

Photosynthesis

Standards Based Formative Assessment

Implementation

Formative assessments are designed to provide information for both students and teachers in assessing what content areas are “proficient” and what areas are still “learning in progress”. They can provide students descriptive feedback on specific student learning expectations (SLEs) and instruct teachers on content that might need to be readdressed. This formative assessment covers only the learning targets for photosynthesis and should be given after all sessions and activities are explored.

Learning Targets

SLEs- MC.3.B.4- Describe and Model the conversion of light energy to chemical energy in photosynthetic organisms:

- Light dependent reactions
- Light independent reactions

Item #	Learning Target Assessed	Pattern of Reasoning	Item Type
1	Light Dependent Reaction	Knowledge	MC
2	Light Independent Reaction	Knowledge	MC
3	Form and Function of Photo system parts	Comprehension	SA
4	Light Dependent/Independent Reaction	Analysis	ER
5	Photosynthesis general process	Comprehension	MC
6	Photosynthesis general process	Comprehension	MC
7	Light Dependent Reaction	Knowledge	MC
8	Light Independent Reaction	Knowledge	MC
9	Photosynthesis general process	Comprehension/Application	SA
10	Form and Function of Photo system parts	Knowledge	MC
11	Photosynthesis general process	Application/Analysis	SA

MC- Multiple Choice, ER- Extended Response, SA- Short Answer

Resources:

Miller, K. & Levine, J. (2006) *Prentice Hall Biology*. Upper Saddle River: Pearson Publication.

- Answers and select questions (page 217, questions 6, 10;) on assessment were provided by the book)

Format of Formative assessment was modified from example of Dr. Donna Snodgrass, Director of Classroom Assessment, Cleveland Municipal Schools found in *Leading Professional Development in Assessment for Learning* notebook facilitated by Jan Chappuis on February 25-26, 2009.

Format for Student Self-Assessment was taken from *Leading Professional Development in Assessment for Learning* notebook facilitated by Jan Chappuis on February 25-26, 2009.

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1. What two products are created by the light dependent reactions?
- a) Glucose and O₂
 - b) RUBP and CO₂
 - c) CO₂ and H₂O
 - d) ATP and NADPH

2. The Calvin Cycle reactions of photosynthesis are also known as the
- a) ATP synthesis
 - b) NADPH synthesis
 - c) light-independent
 - d) light-dependent

3. Briefly describe how a photosystem absorbs light.

4. Explain four differences between light dependent and light independent reactions.

5. Photosynthesis converts
- a) light energy to chemical energy.
 - b) chemical energy to light energy.
 - c) light energy to heat energy.
 - d) chemical energy to mechanical energy.

6. The first process in the light-dependent reactions of photosynthesis is
- a) ATP production.
 - b) electron transport.
 - c) oxygen production.
 - d) light absorption.

7. Which process is most directly driven by light energy?
- a) ATP synthesis
 - b) Carbon fixation in the stroma
 - c) Reduction of NADP+ molecules
 - d) Removal of electrons from chlorophyll molecules**

8. Which of the following occurs in the Calvin Cycle?
- a) Release of oxygen
 - b) Creation of ATP
 - c) Carbon fixation
 - d) Splitting of water

9. Briefly explain how the events in the Calvin cycle depend on the light-dependent reactions.

10. Chloroplast is the part of the leaf that captures the sun's energy. What two chloroplast structures execute the entire process of photosynthesis?
- a) Rubisco and Stomata
 - b) Thylakoid and Stroma
 - c) Carotenoids and Stroma
 - d) Thylakoid and Pigment molecules

11. What color of light is least effective in driving photosynthesis? Explain.

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Answer Key

1. D
2. C
3. **2 points**- Response includes sun's energy is absorbed in molecules called pigments. The primary pigment is called chlorophyll, with two main types: Chlorophyll a and Chlorophyll b.
1 point- Response gives only a generalized statement that the leaf absorbs sunlight, but does not identify chlorophyll a, b or pigments.
0 points- no response or incorrect response.
4. **4 points**-Answers could vary, but should identify to which reaction they are referring. For example- Light Dependent- a) occurs in thylakoid membrane, b) converts light into chemical energy by making NADPH and ATP. Light Independent- a) takes place in stroma, b) Uses ATP and NADPH to convert CO₂ into sugar.
3 points- Contains only three correct answers
2 points- Contains only two correct answers
1 point- Contains only one correct answer
0 points- no response or incorrect response.
5. A
6. D
7. D
8. C
9. **2 points**- The response should include the production of ATP and NADPH as chemical energy resources for the Calvin Cycle.
1 point- Only identifies one of the two molecules or only states the Calvin Cycle receives chemical energy from the light dependent reaction.
0 points- no response or incorrect response.
10. B
11. **2 points**- Response identifies correctly the color that is least effective (Green and or wavelength ~550nm) and two reasons for the explanation. Chlorophyll a and b absorb violet- blue and red light waves primarily. The action spectrum illustrates light absorption versus wavelength and supports this finding. Carotenoids absorb shades of yellow and orange.
1 point- Response contains correct color but only one correct reason.
0 points- no response or incorrect response.

Student Self Assessment on Target Learning

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Formative Assessment Results					Student Understanding		
Problem #	Learning Target	Right	Wrong		Knew the answer	Somewhat knew / Gussed	Did not know at all
1	LD Reaction						
2	LI Reaction						
3	Form/Function						
4	LD/LI Reaction						
5	Photosynthesis						
6	Photosynthesis						
7	LD Reaction						
8	LI Reaction						
9	Photosynthesis						
10	Form/Function						
11	Photosynthesis						

What are my strengths?

My highest priority for studying:

What I need to review:

Action Plan:

- I'll start studying _____
○ DATE
- And work until _____
○ DATE
- And retest on _____
○ DATE