Carbon Tracking in Photosynthesis

New Regents original practice • Name: _____ Date: _____
Show your work for written answers.

The simplified net model for photosynthesis is $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$. Stable carbon-13 can label a carbon atom so its movement through the model can be traced.

1 Which molecule could carry a carbon-13 label into the model as a reactant?

(1) CO_2

(2) H_2O

(3) O_2

(4) Light

2 Use the net equation to compare the number of carbon atoms on the reactant and product sides for one glucose molecule formed. [1]

Answer and work

_____

_____

3 Exactly two of the six CO_2 molecules used to make one glucose molecule contain a labeled carbon. How many labeled carbons does the glucose contain in this model? Explain. [1]

Answer and work

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_____

4 A plant joins some of the glucose units it makes into starch. Where did the carbon in those glucose units originally enter the model?

(1) As carbon dioxide

(2) As water

(3) As oxygen gas

(4) As light energy

Carbon Label Records

Use the information below to answer the questions.

Two groups of identical plants receive the same amount of light and carbon dioxide. In one group, the carbon dioxide contains a higher fraction of stable carbon-13 than usual. In the second group, the carbon dioxide has its usual carbon-13 fraction. The growth medium is the same.

Group	Carbon dioxide supplied	Carbon-13 fraction in newly formed sugar
A	Enriched in carbon-13	Higher than usual
B	Usual carbon-13 fraction	Usual fraction

5 Which observation best supports the claim that carbon from the air enters plant sugar?

(1) The groups receive the same amount of light.

(2) New sugar from A has a higher carbon-13 fraction after A receives enriched CO_2.

(3) Both groups grow in the same medium.

(4) Both groups receive the same amount of CO_2.

6 Explain why group B helps the class interpret the sugar measurement from group A. [1]

Answer and work

7 Which compound in the net model directly receives the traced carbon in the products?

(1) O_2

(2) H_2O

(3) $C_6H_{12}O_6$

(4) CO_2

8 A student concludes that all carbon atoms in the sugar from group A must be carbon-13. Explain why the table cannot establish that claim. [1]

Answer and work