Photosynthesis: What Goes In, What Comes Out

Grades 6-8

Name _____ Date _____

Directions: A wavy arrow carries energy; a straight arrow carries a substance. For Table 1, testers moved a lamp away from a water plant and counted the gas bubbles that rose from the plant.

carbon dioxide	chlorophyll	glucose	light energy	minerals	oxygen	water

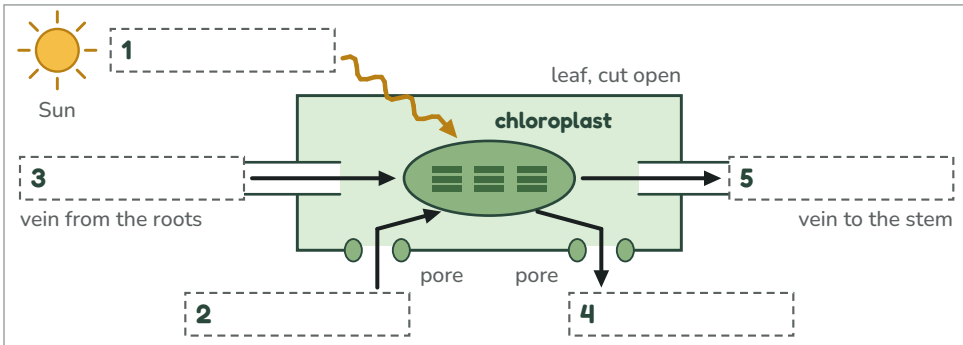


Table 1 (SIMULATED data)
for items 3, 4 and 5

Lamp distance cm	Bubbles in 1 minute
10	42
20	27
30	15
40	8

Table 1 is simulated: no plant was tested, and the four bubble counts were invented for this page.

1. Write a bank word in each of the five numbered boxes of the drawing. Two bank words are left over.
2. Dry spruce wood is rich in carbon atoms. (a) Which numbered arrow brought that carbon into the tree? _____ (b) Where does a tree take that substance from? _____
3. (a) Table 1: as the lamp moves away, the bubble count _____. (b) Use arrow 1 to explain why.

4. (a) The counts at 10 cm and at 40 cm differ by _____ bubbles per minute. (b) From one row to the next, the count changes the most between _____ cm and _____ cm.
5. (a) The bubbles are the gas at arrow _____. (b) Name two things that must stay the same at all four distances to keep the test fair.

6. Sort statements A to F. Photosynthesis: _____ Cellular respiration: _____

   A. It runs only while light reaches the cell.
   B. It runs in every living cell, day and night.
   C. It releases energy from food for cell work.
   D. It takes place inside chloroplasts.
   E. It gives off the substances at arrows 2 and 3.
   F. It stores energy in food molecules.

7. A bottle of garden fertilizer has "plant food" printed on its label. (a) What is the real food of a green plant, and where is it made? (b) What does fertilizer give the plant instead?

8. A leaf that is short of water closes its pores. (a) Which two numbered arrows are cut off? _____ and _____ (b) What happens to photosynthesis in this leaf, and why?

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Answer key

Points for items 1 to 8: 5, 2, 2, 2, 3, 6, 3, 3. Total 26. Spelling does not cost a point when the word is clear.

1. **1 light energy; 2 carbon dioxide; 3 water; 4 oxygen; 5 glucose**

Left over: chlorophyll and minerals. Arrows 1, 2 and 3 point in (the inputs) and arrows 4 and 5 point out (the outputs). Also accept "light" or "sunlight" for 1 and "sugar" for 5. The boxes are small, so also accept CO2, H2O and O2. Minerals ride in the same vein as water, but a student who writes "minerals" at 3 has no box left for water.

2. **(a) arrow 2; (b) from the air**

Carbon dioxide is the only input that holds carbon. It enters the leaves through the pores, and the tree builds most of its dry mass from it, together with water. If item 1 puts carbon dioxide at a different arrow, accept that number in (a). In (b) accept "the atmosphere". "Through the pores" names the door, not the source, and does not earn the point alone. "The soil" is wrong: roots take up water and a little mineral matter, not carbon.

3. **(a) It falls: the farther the lamp, the fewer bubbles each minute. (b) Less light energy reaches the chloroplasts from a lamp that is farther away, so photosynthesis runs more slowly and less gas is made.**

One point for the pattern, one for the reason. Accept "goes down", "drops" or "decreases" in (a). The count falls at every step: 42, 27, 15, 8.

4. **(a) 34; (b) 10 cm and 20 cm**

(a) 42 − 8 = 34. (b) The three changes are 15, 12, 7; the first is the largest. Part (b) is one point.

5. **(a) arrow 4; (b) any two of: the same plant sprig, the same lamp, the same water at the same temperature, the same counting time, no other light in the room**

One point for (a) and one for each of the two things in (b). Accept other sound answers. Only the lamp distance may change. If item 1 puts oxygen at a different arrow, accept that number in (a).

6. **Photosynthesis: A, D, F. Cellular respiration: B, C, E.**

One point for each letter. Respiration takes in glucose and oxygen and gives off carbon dioxide and water, the two substances that photosynthesis takes in. Green plant cells do both; animal cells respire only.

7. **(a) Glucose, which the plant makes itself in the chloroplasts of its leaves. (b) Minerals, which the plant needs in small amounts as building material.**

Three points: the food, the place, the minerals. Accept "sugar" and "in the leaves"; in (b) accept "nutrients" or a named one such as nitrogen. Food is what supplies energy. Minerals from soil or fertilizer supply none, so a plant does not get its food from the soil.

8. **(a) arrows 2 and 4; (b) It slows down, because carbon dioxide can no longer enter and the chloroplasts run short of this input.**

One point for each arrow, one for (b). Oxygen is also trapped inside. Accept "it stops" with the same reason.