

The Life of a Plant in a Jar: Part 2 The Atmosphere



Last week we asked you how a plant in a closed jar could live for an extended period of time. The picture to the left was taken nine days after the plant was placed in the jar. It shows that the plant is still alive, and, with the exception of one leaf that is pressed against the glass, the plant appears in the best of health.

If you applied what you have learned about photosynthesis to the question of how long the plant will live, you might have concluded that the plant would wilt and die in a short period of time. You know

that the plant uses carbon dioxide from the air for photosynthesis, so it is reasonable to conclude that the plant might use up all the carbon dioxide and die. But the plant is still alive and healthy, so we need to rethink the conclusion about the plant using up all the carbon dioxide.

We begin by assuming that when we placed the plant in the jar, the atmosphere in the jar was the same as it was in the room (or on most places on earth):

- approximately 78% nitrogen
- approximately 20% oxygen
- about 2% other gasses, including carbon dioxide (CO_2)

After a day, what changes in the jar's atmosphere would you expect? If the plant is in the sun, it will be undergoing photosynthesis. During this process, CO_2 is taken in and oxygen is released. After a while, we assume there'd be a slight decrease in CO_2 and a slight increase in O_2 ...

But there's not much carbon dioxide in the air at the start. Over time, wouldn't photosynthesis use up all the CO_2 , increasing percentage of O_2 ?

In fact, for a few days, there is a decrease in CO_2 and an increase in O_2 . After two weeks, however, the CO_2 and O_2 levels return to their original levels. So...

Where did the O_2 go?
From where did the added CO_2 come?

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Something else must be happening. The answers lie in the description of the jar in the first email:

*“To focus our thinking about plants and their interactions with the environment, we will create a **system**. The system consists of a green plant in **potting soil** within a closed jar. Light and heat energy can be exchanged between the inside of the jar and its external environment. However, no matter, gases, liquids, or solids can enter or exit the jar.”*

The key words are, believe it or not, “**potting soil**.” We know that our potting soil is not sterile. Although it should be free of harmful insects, molds, or fungi, it is teeming with microorganisms.

These millions of microorganisms *respire*. If you remember back to the December 4, 2002 email, we defined *respiration* as *the life process where chemical energy is converted to other forms of energy* (e.g., heat and motion energy in humans). This occurs in cells of organisms. Oxygen is required for this process, and CO₂ is released. Therefore, the combined effects of photosynthesis and the microorganisms’ respiration keep the percentages of gases in the atmosphere the same, allowing the plant and the microorganisms to grow and thrive for long periods.

You know that animals and many kinds of microorganisms respire, but do plants respire or do they just photosynthesize?

More about the plant in the jar next week.