ANSWER KEY.

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Do Dead Leaves Breathe?

Biology | ANSWER KEY

Sample answers and data. Accept answers that match the group's own data and reasoning.

Draft lab. This lab has not been tested in a classroom yet. Your teacher may change some steps, times or amounts.

The Puzzle

Every fall, tons of leaves drop to the ground. A year later most of them are gone. Where does all that matter go? You will seal leaf litter in a jar with a small cup of **bromothymol blue (BTB)**, a dye that turns from blue to green to yellow as carbon dioxide (CO_2) dissolves in it.

Question

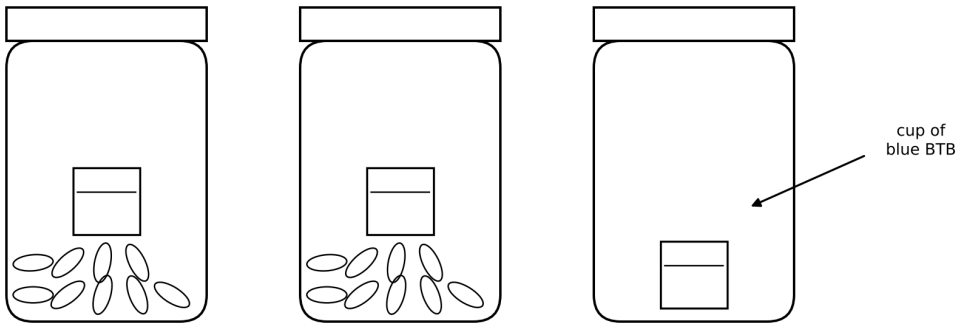
Does moist leaf litter release CO_2, and is something living in the litter responsible?

Safety

- Wear goggles. BTB stains skin and clothes.
- Wear gloves when handling leaf litter, and wash your hands after.
- Microwaved litter is hot. Let your teacher handle it until it cools.

Materials (per group)

- 3 pint jars with lids, labeled L (live litter), M (microwaved litter), and E (empty)
- 3 small cups (film-canister size) with 5 mL of blue BTB each
- About 2 handfuls of moist leaf litter, split into two equal piles
- BTB color card, timer, gloves, goggles



A small cup of BTB sits on top of the litter. The BTB never touches the leaves.

Before the Lab

1. Predict the order in which the three jars will turn yellow. Explain your reasoning.

Answers vary. Expected: L first, M much later or not at all, E stays blue. Live decomposers respire; microwaving kills most of them.

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2. What is the purpose of the empty jar (E)?

It is a control. It shows whether the BTB changes color on its own or from CO_2 already in the jar's air.

Procedure

1. Your teacher has already microwaved one pile of litter for 2 minutes and let it cool. Put it in jar M.
2. Put the other pile of litter (same amount) in jar L. Leave jar E empty.
3. Gently set a cup of BTB on top of the litter in each jar so it stays upright. Do not let litter fall into the cup.
4. Close each lid tightly. Record the starting color (time 0) using the color card.
5. Record the color every 10 minutes for 40 minutes. Do not open the jars.
6. Optional: leave the jars sealed overnight and record the color the next day.

Data

Color scale: 1 = blue, 2 = blue-green, 3 = green, 4 = yellow-green, 5 = yellow

Table 1. BTB color score

Jar	0 min	10 min	20 min	30 min	40 min	Next day
L (live litter)	**1**	**2**	**3**	**4**	**4**	**5**
M (microwaved litter)	**1**	**1**	**1**	**2**	**2**	**4**
E (empty)	**1**	**1**	**1**	**1**	**1**	**1**

Analysis

3. Which jar changed fastest? What does the color change tell you was added to the air in that jar?

Jar L (live litter) changed fastest. Yellow means CO_2 built up in the jar's air and dissolved in the BTB.

4. Dead leaves cannot respire. What living things in the litter released the CO_2? What were they using for food?

Decomposers: bacteria, fungi, and small animals such as mites and springtails. They use the carbon compounds in the dead leaves as food and release CO_2 by cellular respiration.

5. Jar M changed slowly (or not at all). What does this tell you about the cause of the CO_2 in jar L?

Microwaving killed most of the decomposers, so little CO_2 was released. The CO_2 in jar L came from living organisms, not from the leaves themselves.

6. If jar M turned yellow by the next day, suggest a reason.

Some microbes or spores survived the microwave, or new microbes reached the litter, and they grew and respired overnight.

7. Use the carbon cycle: where was the carbon in the leaves before they fell, where did it go in this lab, and where could it go next?

It was in sugars and other molecules the tree built from CO_2 by photosynthesis. Decomposers released it back to the air as CO_2. A plant could take it in again by photosynthesis.

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8. Claim, evidence, reasoning: Does decomposition make matter disappear?

Claim

No. Decomposition changes the matter in dead leaves into CO_2 gas and other molecules; the atoms are not destroyed.

Evidence

Jar L's BTB turned yellow in about 30 minutes, showing CO_2 was released. Jar E stayed blue.

Reasoning

Decomposers respire, breaking down carbon compounds from the leaves and releasing the carbon as CO_2. Atoms are conserved, so the leaf matter moved into the air.

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