



Why Do Leaves Change Color in the Fall?

Video: 3:21 · Episode 003

Grades: 4–8 · Biology / Chemistry

Time: 30–45 min (video + worksheet + quiz)

Key term: chlorophyll (KLOR-uh-fill)

Connects to NGSS: 4-LS1-1 (plant structures that support survival) · 4-PS4-2 (light reflected from objects enters the eye) · MS-LS1-6 (photosynthesis: light energy used to make food)

The big idea

The yellow and orange in fall leaves were there **all summer**, hidden under a lot of green. Chlorophyll wears out in sunlight, so all summer the leaf keeps making more. When nights get longer in fall, the tree stops making new chlorophyll. The green fades, and the yellow finally shows. Red is different: it is made new in fall, from sugar trapped in the leaf.

One-line recap students should be able to say: "Leaves change color because the green fades away, and the other colors finally get their turn."

Learning goals

- Explain that chlorophyll catches sunlight to make food (sugar) and makes leaves look green.
- Explain that yellow/orange colors are present all summer but hidden by the green.
- Explain that longer nights trigger the tree to stop making chlorophyll.
- Tell how red leaves differ from yellow ones (red is made new, from trapped sugar).
- Give one reason trees drop their leaves before winter.

How to use it

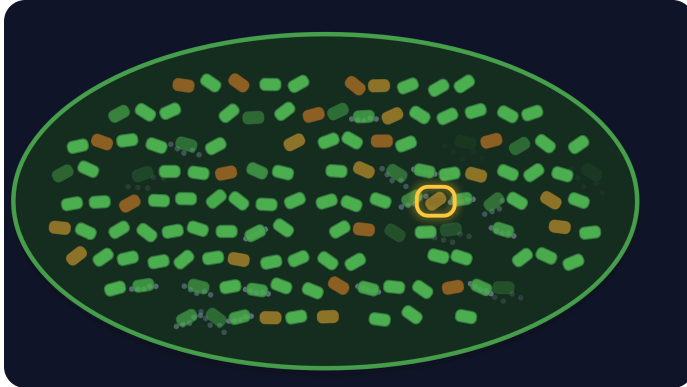
1. **Before watching (3 min):** students answer the prediction on the worksheet. Don't correct them yet.
2. **Watch (4 min):** play the video once straight through. Pause at about 2:02, right after "It took away the green," if you want a check-in.
3. **Worksheet (10 min):** fill in the blanks, then draw the "bean" before and after fall.
4. **Discuss (10 min):** pick two or three discussion questions.
5. **Quiz (5 min):** six quick questions; answer key on the last page.

What the video simplifies (so you can answer the sharp questions): the "green beans" are chloroplasts, and the colored chips stand in for pigment molecules. The yellow/orange pigments are *carotenoids*; the reds are *anthocyanins*; browns come mostly from *tannins* left behind. Night length is the main trigger, but temperature plays a part. Before leaves drop, trees pull back nutrients, especially nitrogen. Frost does *not* cause the color change; many leaves turn before the first frost.

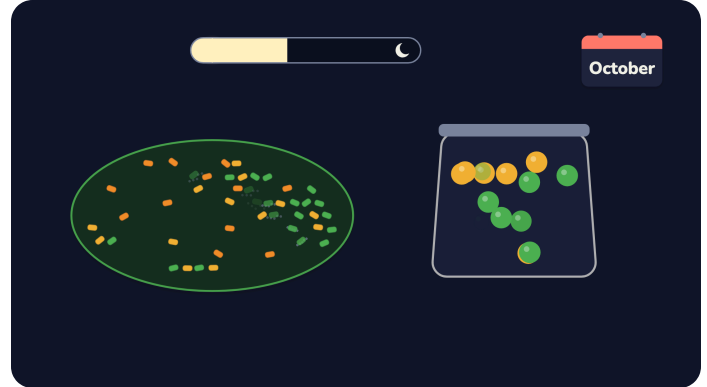


Find the Hidden Yellow

Students separate the colors in a **green** leaf and find the yellow the video says is hiding there. This is paper chromatography: different colors travel up paper at different speeds.



From the video: yellow hiding among the green



When the green goes, the yellow is left

You need (per group)

- 3–4 fresh **green** leaves (spinach works very well)
- Small glass jar or cup, rubbing alcohol (isopropyl, 70% or higher)
- A strip of coffee filter about 1 in × 5 in, a pencil, tape, a spoon

Steps

1. Tear the leaves into tiny pieces and put them in the jar.
2. **Adult step:** add just enough rubbing alcohol to cover the pieces. Mash with the spoon for 2–3 minutes until the alcohol turns green.
3. Tape the top of the filter strip to the pencil and lay the pencil across the jar so the bottom of the strip just touches the liquid.
4. Wait 30–60 minutes. Watch the colors climb the strip.
5. Look closely: above or below the green band you should see a **yellow** band.

Safety: rubbing alcohol is flammable and should not be swallowed or sniffed up close. Use it away from flames, with an adult handling it, in a ventilated room. Wash hands afterward.

Talk about it

- The leaf looked completely green. Where did the yellow come from?
- How does this match what the video showed inside the "bean"?
- Would you expect to see a red band from a green summer leaf? Why or why not? (Usually no: most red is made in fall.)



Why Do Leaves Change Color in the Fall?

Name: _____

Date: _____

Before you watch

A leaf is green in July and yellow in October. Where do you think the yellow comes from?

While you watch: fill in the blanks

1. The green stuff in a leaf that catches sunlight is called _____.
2. The leaf uses sunlight to make _____, the tree's food.
3. Leaves look green because chlorophyll bounces _____ light back to your eyes.
4. Chlorophyll wears out, so all summer the leaf keeps making _____.
5. In fall, the _____ get longer, and the tree stops making new chlorophyll.
6. The tree didn't add the yellow. It took away the _____.

Draw it

Draw the inside of the leaf's "bean" in summer and in fall. Use colors or labels.

SUMMER (July)**FALL (October)**

Explain it

Use the candy bag from the video to explain to a friend why a green leaf can turn yellow.



Talk It Over, Then Check Yourself

Discussion questions

1. Before the video, many people guess that frost paints the leaves. What evidence in the video shows that's not it?
2. Why do you think the tree takes back the useful stuff from its leaves before dropping them?
3. Pine trees stay green all winter. What questions would you ask to figure out how they're different?
4. One fall is sunny with cool nights. Another is cloudy and rainy. Which one would have more red leaves? Why?
5. The video says "the tree senses the long nights." Why might night length be a better signal than temperature for knowing it's fall?

Quiz

Name: _____

1. What does chlorophyll do? (Circle one.)
A. Makes leaves fall off
B. Catches sunlight to make food
C. Makes leaves red
D. Keeps leaves warm
2. Where were the yellow colors in a leaf during summer?
A. In the roots
B. Nowhere; they're made in fall
C. In the leaf, hidden by green
D. In the air
3. What is the main signal that tells the tree it's fall?
A. Longer nights
B. The first frost
C. Falling acorns
D. Rain
4. True or false: red leaf color is made new in the fall. _____
5. Which weather makes the brightest red leaves?
A. Cloudy, warm, and rainy
B. Sunny days and cool nights
C. Snowy days
D. Hot nights
6. Give one reason trees drop their leaves before winter.



Answer Key

Worksheet: fill in the blanks

1. chlorophyll · 2. sugar · 3. green · 4. new chlorophyll · 5. nights · 6. green

Draw it: summer shows lots of green with a few yellow/orange pieces mixed in; fall shows the green gone and the same yellow/orange pieces left.

Explain it: a bag with mostly green candies and a few yellow ones looks green. Take out the green ones and you see the yellow, even though no yellow was added.

Quiz

1. **B.** Catches sunlight to make food.
2. **C.** In the leaf, hidden by green.
3. **A.** Longer nights. (Temperature plays a smaller part; frost is not the cause.)
4. **True.** Most red is made in fall from sugar trapped in the leaf.
5. **B.** Sunny days make lots of sugar; cool nights keep it trapped in the leaf.
6. Any one: when the ground freezes the tree can't get water, and leaves would let water escape so the tree dries out; thin leaves can be damaged by freezing; snow piling on leaves can break branches.

Discussion: points to listen for

1. Leaves start changing before the first frost (the video's 60°F tree).
2. Nutrients like nitrogen are valuable; saving them helps the tree survive winter and grow new leaves in spring.
3. Leaf shape (needles), waxy coatings, how long the leaves last. (Pine needles have a thick wax coat and can stay on the tree for 2–4 years.)
4. The sunny fall: more sugar is made, and cool nights keep it in the leaf to become red.
5. Temperature jumps around (warm spells, cold snaps), but night length changes the same way every year.

See Why · "We make invisible things visible." Free to copy for classroom and homeschool use.