

How to “NGSS-ify” Your Curriculum (The Quick and Easy Way!)



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What is this session all about?

We are **NOT** going to...

- Go over the NGSS standards
- Show you how to align your curriculum to the standards
- Create lesson plans

We **ARE** going to...

- Focus on the teaching philosophy behind NGSS
- Put you in your students' shoes
- Show you a way to start the NGSS philosophy in your classroom tomorrow!

Where does the mass of a plant come from?



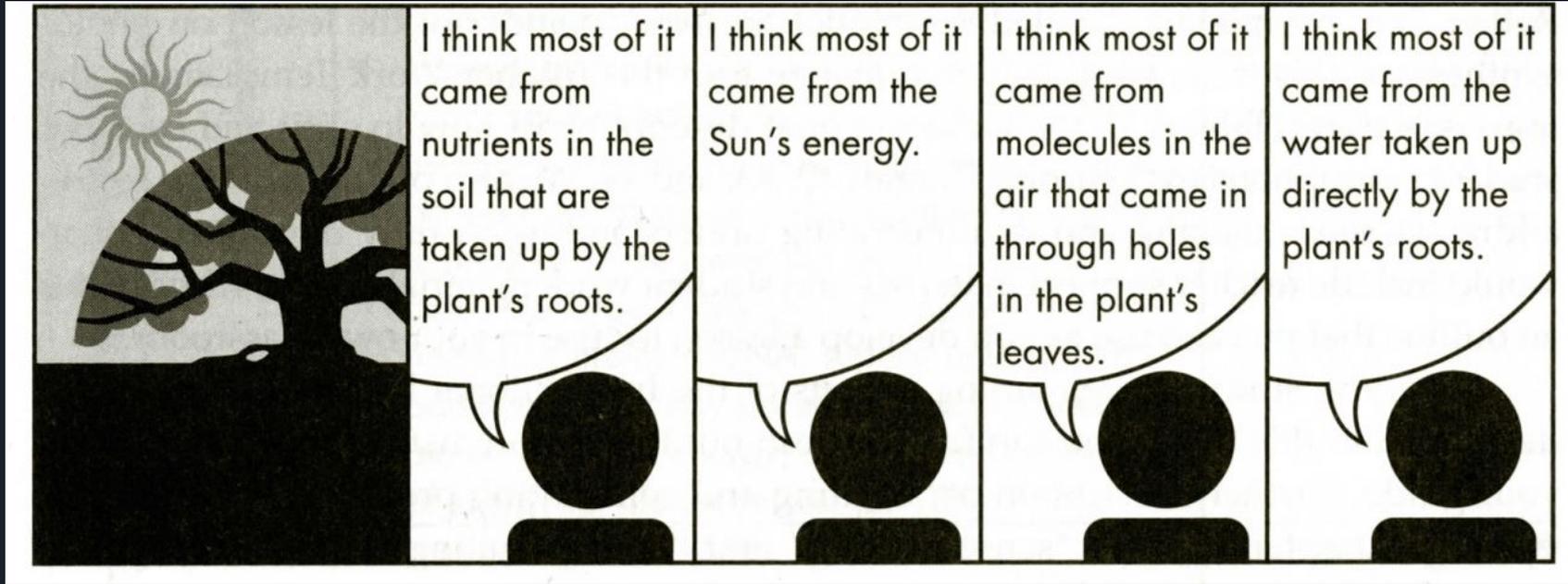


What do plants need to grow
(do mitosis/make more cells)?



What percentage of each of these do you think make up the final mass of the plant?

Break up into groups!



The diagram illustrates a landscape with a sun in the sky and a tree on a hill. Below the landscape, four speech bubbles are arranged horizontally, each containing a different theory about the source of a plant's growth. The theories are: 1) nutrients in the soil taken up by the plant's roots, 2) the Sun's energy, 3) molecules in the air that came in through holes in the plant's leaves, and 4) water taken up directly by the plant's roots.

I think most of it came from nutrients in the soil that are taken up by the plant's roots.

I think most of it came from the Sun's energy.

I think most of it came from molecules in the air that came in through holes in the plant's leaves.

I think most of it came from the water taken up directly by the plant's roots.

Time to find
EVIDENCE!



How much of a plant's mass do you think comes from each of the following?



Explain the evidence and reasoning that supports your conclusion.

The sun's energy

a lot a small amount none

CO₂ in the air that come in through holes in the plant's leaves

a lot a small amount none

Water taken up by the plant's roots

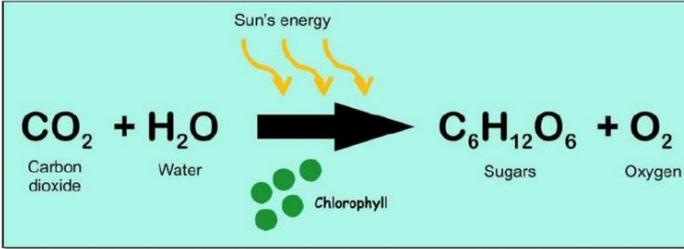
a lot a small amount none

Nutrients in the soil that are taken up by the plant's roots

a lot a small amount none



Shift from Learning About to Figuring Out



“Define photosynthesis”



Where did all the mass come from?

How does it get the energy to grow so tall?

What's inside the seed that makes it grow into an oak tree rather than some other kind of tree?





Flipping the Script

(The quick and easy way to do NGSS)

1. Do the labs/activities/investigations FIRST.
2. Follow up with notes/discussions/assessments.

FLIPPING THE SCRIPT



One way you could assess their learning...

CLAIM - EVIDENCE - REASONING

- Students answer that “driving question” from the start of the unit.
- Need to use evidence from class to support their answer.
- Explain the phenomenon.

Students learn to **understand** and not just memorize and regurgitate.

NGSS requires higher-order thinking skills by design.

We want to stop this from happening...





THANK YOU!



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I think most of the mass came from nutrients in the soil...

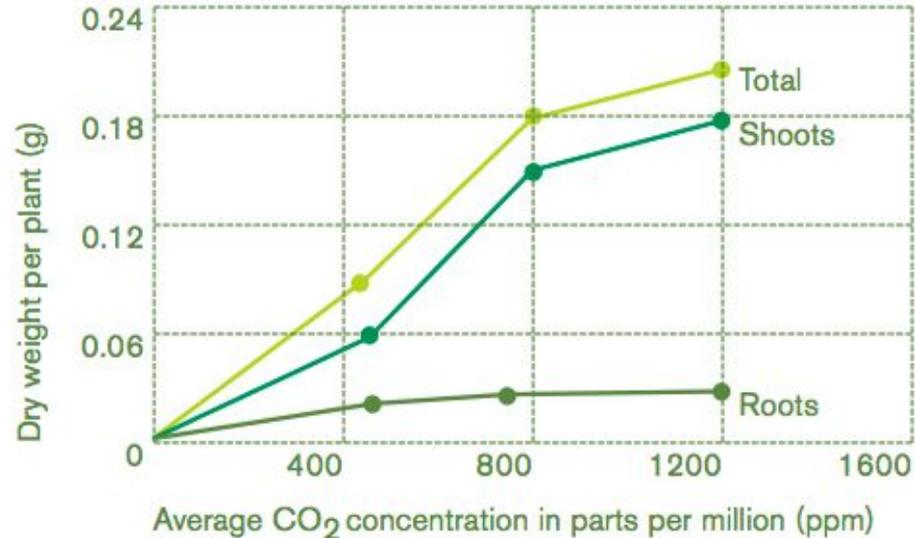
- How much did the mass of the soil decrease over the five years?
- Could this have contributed to the growth of the plant? How much?
- Can plants grow without soil?
- Can plants grow without minerals?
- Do minerals have an effect?
- Do you think it is correct to say that some of the tree came from minerals in the soil? How much could the minerals have contributed to growth?

I think most of the mass comes from the Sun's energy...

- Does sunlight have mass?
- Living things are made of atoms. Does sunlight contain atoms?
- Could sunlight add to the mass of the plant?
- Is sunlight needed for plants to grow? What role does it play?
- Do you think it is correct to say that plants make their food from sunlight? Try to summarize your thoughts using some of the points above to support your argument.

I think most of the mass came from the molecules in the air...

- What gases are in the air?
- Do the gases in the air have mass?
- How could you show that these gases have an effect on increasing the mass of a plant?
- Look at the results of an experiment that examined the growth of plants at three different concentrations of carbon dioxide. What does it tell you? Can gases in the air affect growth?



Most of the mass came from the water taken up by the plant's roots...

- Is water a food source?
- Would you survive on water alone?
- Do we know how much water van Helmholt added to the pot over the five years?
- What should van Helmholt have done if he had wanted to prove that all this increase in mass was from water?
- Do you think that water accounts for the some of the growth of the willow tree? Try to summarize your thoughts using some of the points above to support your argument.

In 1642-47, van Helmholt carried out a classic experiment to evaluate where a plant's mass came from. He grew a willow tree in a pot and added only water during the five-year experiment. He recorded the weight of the tree and the weight of the dried soil in the pot at the beginning and end of his experiment. Complete the following table to show the change in weight of the tree and the dried soil.

	Weight of Tree	Weight of Dried Soil
1642	5 pounds	200 pounds
1647	169 pounds, 3 ounces	199 pounds, 14 ounces
Change in Weight		