

Topic	Nitrogen deficiency in water logged soils	Level	GCSE (or any other course for students aged 14-16)
Outcomes	<ol style="list-style-type: none"> 1. To describe and explain why waterlogged soils prevent active transport through the displacement of soil oxygen 2. To know that nitrogen is needed to make proteins such as chlorophyll 3. To describe and explain the process of ion leaching 		
Information for teachers	<ul style="list-style-type: none"> • This activity provides a time for students to apply their knowledge of diffusion and active transport to solve a novel problem involving nitrogen deficiency in waterlogged soils. Only use this activity once students have developed a reasonably good understanding of active transport, ion uptake, respiration and diffusion. Provide time for students to come up with their own solutions to the problem, before providing time for small group discussions. Finally, students use all the information to write an explanation to the problem: why does a plant grown in waterlogged soil have yellow leaves? 		

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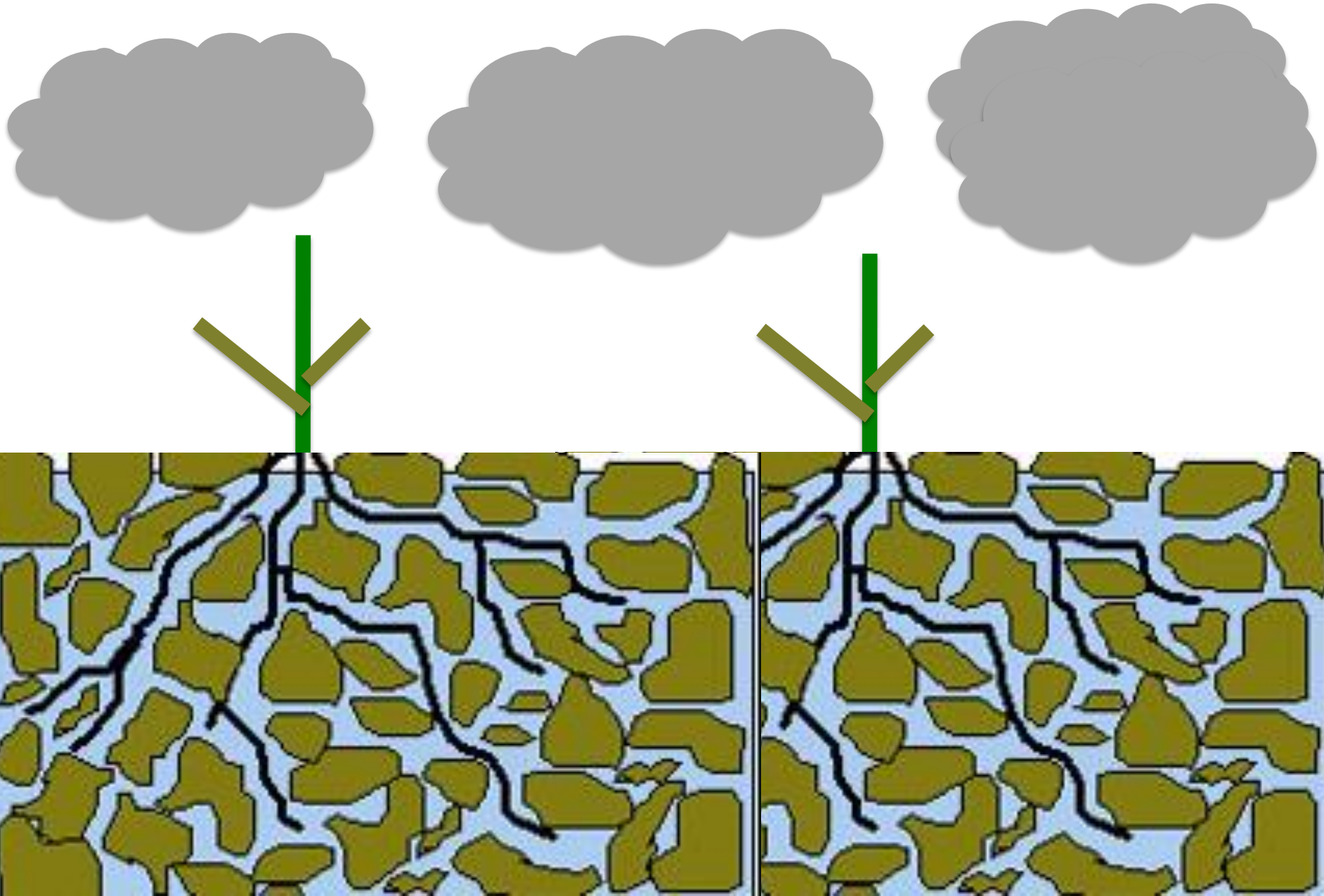
Plants get their nitrogen from the soil in the form of nitrate ions (NO_3^-).

Plants use nitrogen to make proteins, such as chlorophyll.

This plant is nitrogen deficient. How do you know?

Why does a plant grown in waterlogged soil have yellow leaves?

Write, think, pair, share



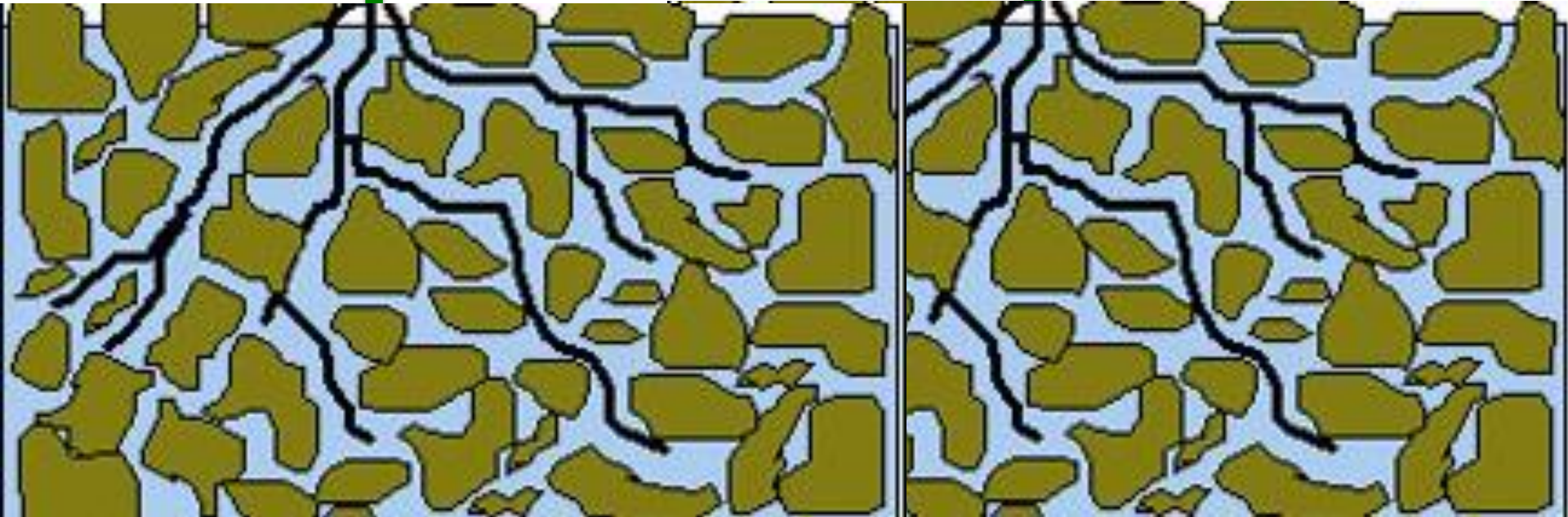
Why does a plant grown in waterlogged soil have yellow leaves?

Some ideas to help....

Nitrate ions
are soluble.

The soil is not
aerated.

Nitrogen is
needed to
make
chlorophyll.



Instructions

In each rain cloud there is a partial explanation for why plants grown in waterlogged conditions show nitrogen deficiency.

Complete these partial explanations in pairs by providing a more detailed explanation.

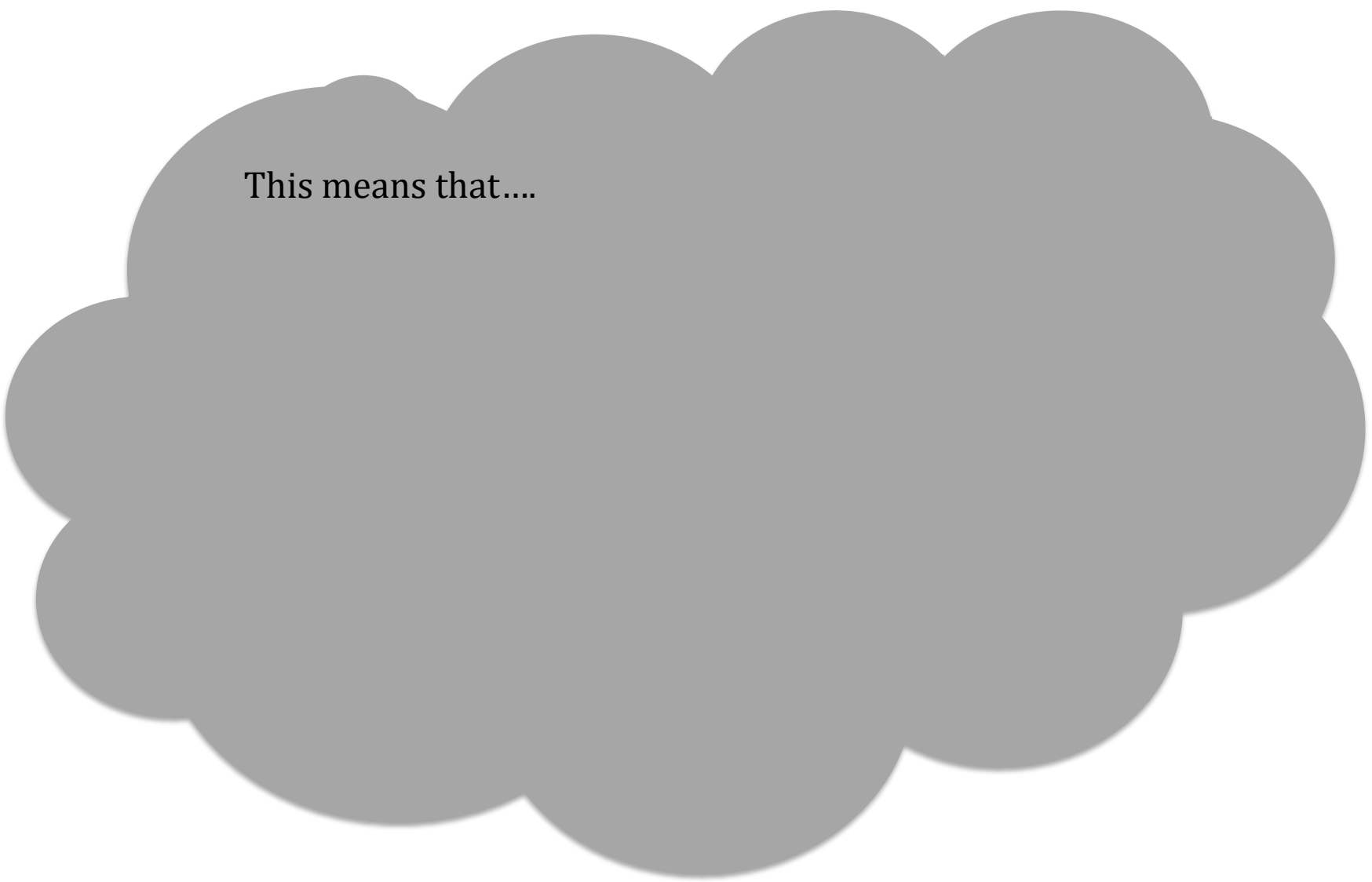
Nitrate ions are soluble.

This means that...



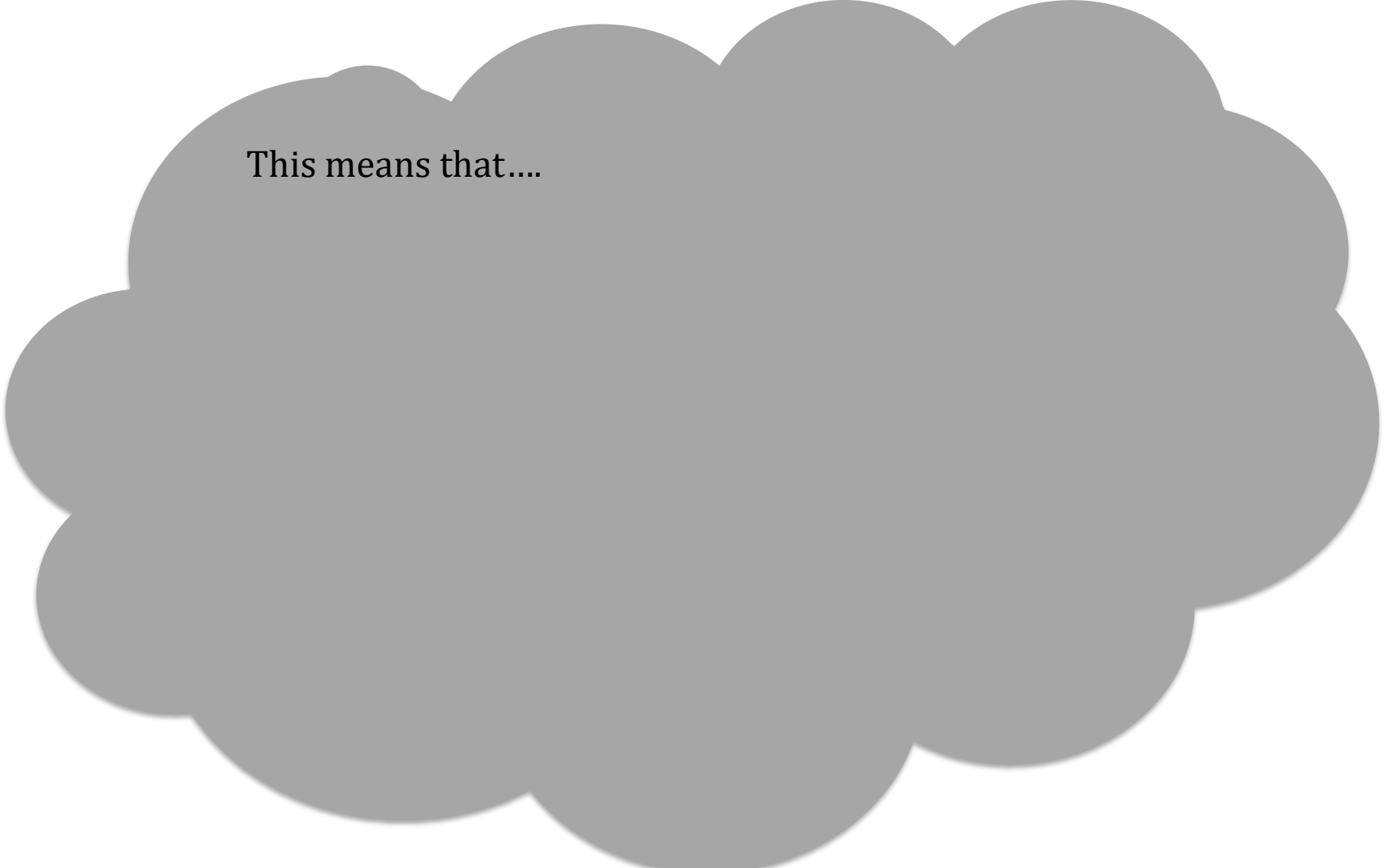
The soil is not aerated.

This means that....



Nitrogen is needed to make
chlorophyll.

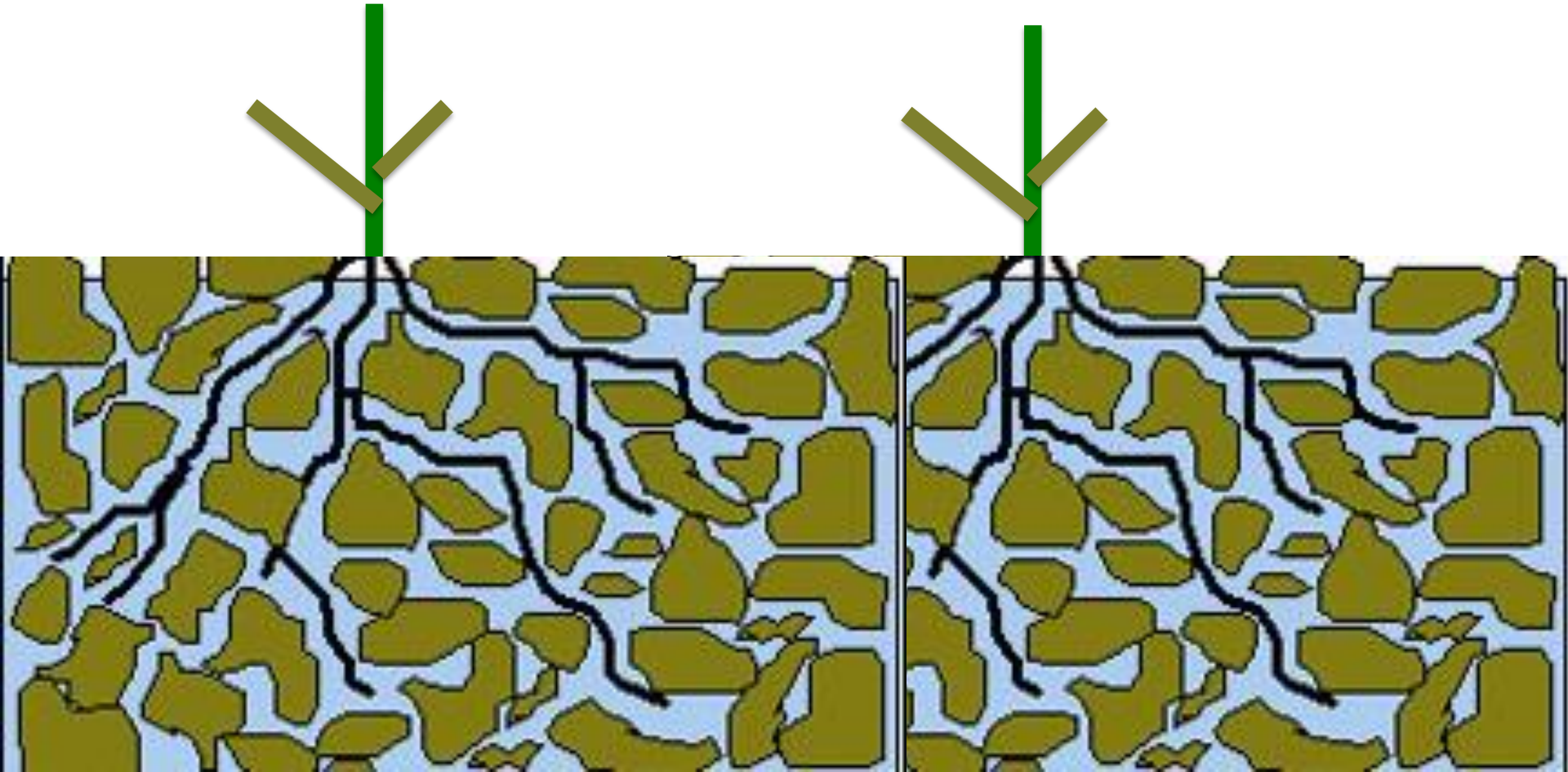
This means that....



Why does a plant grown in waterlogged soil have yellow leaves?

Write a paragraph to answer this question. In your answer make sure you have explained:

- why nitrate ions need to be absorbed by active transport and not diffusion
- why roots in waterlogged soil can't do active transport
- why the leaves are yellow



Nitrate ions are soluble.

This means that....

in waterlogged soil, many nitrate ions will be washed away (leaching). The concentration of nitrate ions in the soil will therefore be lower than inside the root hair cells. This means that the root hair cells will need to take up nitrate ions against a concentration gradient using active transport.

The soil is not aerated.

This means that....

in waterlogged soil there is not enough oxygen because the air in the soil is displaced by the water. This means that aerobic respiration cannot take place in root hair cells and so there is not enough energy available for active transport of nitrate ions to take place.

Nitrogen is needed to make chlorophyll.

This means that...

if a plant cannot absorb enough nitrate ions it will not have enough nitrogen available to make the green chlorophyll pigment. This will mean the plant leaves will look yellow.