Growing our island: Food, Nature & Future

Teacher manual on school gardens for pre-schools and primary schools on St. Eustatius

Developed by Silke Jonkers

For the project “Towards a coherent program for green-blue education on Saba and St. Eustatius”
May 2026

Table of content

3 Why this project
4 Teaching manual
6 Didactical approach
7 - Five NME Development Areas
8 - The principles of LvDO
11 - Didactic coaching
13 Lessonplan over the weeks
17 Learning goals
18 Background information gardening
26 Lessons
27 1. What does a plant need to grow?
32 2. The seeds of a plant
37 3. Parts of a plant
42 4. The roots of a plant
48 5. From flower to fruit
52 6. Green jobs and future skills
59 7. Soil and soil animals
61 8. The water cycle
71 9. The sun and photosynthesis
76 10. Local and import foods
81 11. Foodwaste, compost, nutriencecycle
87 12. What part of the plant do you eat?
92 13. Healthy eating and nutrition
98 14. Reflection
101 Literature
106 Attachments

Why this project?

This project is designed to embed education on gardening, plants, food, and health into the school curricula. This is done with a greenhouse or mobile gardens where the pupils can develop practical skills related to food production and sustainability. In this lesson series, they can gain an understanding of where food comes from, how plants grow, and what healthy and sustainable living means.

In these lessons, the pupils will start to get an understanding of maintaining a vegetable/fruit garden in or on the premises. With hands-on learning, experiments, and assignments, they will get the experience of growing their own food, taking care of it, harvesting it, and tasting it. Themes such as soil, water, sun, healthy eating, and sustainability are included.

These lessons are a result of a initiation by the Ministry of LVVN, in collaboration with OCW and the Public Entities to set up the project “Towards a coherent program for green-blue education on Saba and St. Eustatius”. These lessons are a part of this project to create a coherent program that places nature, sustainable agriculture, food security, healthy eating and water at the center of education (Sonneveld, 2025).

Teaching material manual

This teaching manual is created for teachers who are gardening with students from the ages of 4 to 12. These lessons are built around different topics regarding gardening, soil, water, food, nutrition, and system thinking with hands-on learning. The topics are divided into 13 themes from which the lessons are developed.

Each theme consists of background information on that topic. This is supported by pictures, illustrations, and diagrams. Following the additional information for the teacher are the lesson activities, which are divided into four groups. The division between the groups are:

Group 1-2

Age 4-6

Group 3-4

Age 6-8

Group 5-6

Age 8-10

Group 7-8

Age 10-12

Each group has their own color that is continually structured throughout the entire document.

References to attachments may be included in the descriptions for the lesson activities. These will be in the appendix.

Teaching material manual

Every lesson consists of:

- A learning goal
- Additional video material for students if necessary
- A description of an activity to support that topic
- Questions to ask at the end of the lesson to integrate the knowledge and revise the activity

Some lessons have highlighted didactical approaches in that lesson to stimulate things like critical thinking, action-based learning, or the development of autonomy.

More about the didactical approach used in the creation of this document will be found in the following pages.

In each lesson description there will be symbols of the mind, heart, and hands. These correspond with the five NME* Development Areas, which are to be strengthened according to the analysis report from 2025 by Ard Sonneveld in cooperation with STENAPA**. (Sonneveld, 2025). The full description of the five NME Development Areas is on page 6 and 7.







*NME = Nature and Environmental Education
**STENAPA = St. Eustatius National Parks foundation

Didactical approach

Five NME Development Areas
The principles of LvDO
Didactic coaching

Didactical approach

There are three conceptual frameworks that have played a role in the development of this module about ..... These are:

- Five NME Development Areas (Verheijen, Van Koppen, Wammes & Jansen, 2010)
- The principles of LVDO (Leren voor Duurzame Ontwikkeling / Education for Sustainable Development) (Frijters, 2016)
- The didactical approach of Coaching for Learning (Faber & Voerman, 2024).

Five NME Development Areas

1) Wonder

The development of the positive, emotional, and appreciative relationships with the environment. Curiosity plays a part by wondering how things work and seeing the beauty of the surroundings. Wonder primarily involves the 'heart' of learning

2) Care

Consider moral obligation of caring for people, animals, and ecosystems, both now and in the future. Central values are justice, solidarity, and fair distribution of resources.

3) Understanding

This involves the knowledge and comprehension of social, ecological, and physical-chemical processes, as well as the more extensive worldview in which people see themselves as connected to their environment. This involves the 'head' of learning facts, concepts, relationships, and systems.

Didactical approach

4) Research skills 

The development of the ability to observe, ask questions (critical thinking), seek information, investigate, measure, analyze, and interpret results. It is both a concrete skill and a critical and investigative attitude that is to be developed and honed.

5) Action skills 

The abilities that are needed to make choices, take joint decisions, and take concrete action. This includes everything from small, practical changes to participating in broader decision-making processes.
(Verheijen, Van Koppen, Wammes & Jansen, 2010).

<u>The principles of LVDO</u>

Sustainable development is the interconnectedness between people (social), planet (ecology) and profit or prosperity (economy), and with that, it is cross-disciplinary and applicable in a widespread context. Through an integrated approach, LvDO strives to give students the opportunities to acquire knowledge, skills, attitudes, and values in relation to sustainable development. They not only learn about it but also will be a participant in the process of sustainable development. One of the most important outcomes of LvDO is qualifying students to act so that they can make well-considered choices as citizens for a sustainable future.

Didactical approach

There are six core principles that come from the didactic lens of LvDO, that played a role in the development of the lessons and are woven throughout. These are:

- Student-centered
- Value-oriented and focused on critical thinking
- Participation and collaboration
- Action-oriented
- Complexity and coherence
- Inquisitive attitude

When carrying out these lesson series, it is important to understand these core principles and the effect of you as a teacher on the students. The learning outcomes of LvDO include action, competence, and striving for an investigative attitude, but these skills alone will not suffice. Knowledge is a crucial factor in creating the envisioned depth in the learning activities. As a teacher, you are willing to obtain new knowledge about sustainability and to innovate in teaching methods. Transformative learning outcomes for students require value orientation, critical thinking and reflection, a non-linear, dynamic teaching approach to match.

Teacher competence for sustainable development that is integrated in the forming of these lessons.:

Pedagogical competent:

- providing a safe learning environment and promote personal, social, and moral development and to support their development and into independent and responsible

Didactical approach

individuals. → Giving students the opportunity to take responsibility in assignments and actions and to be independent in activities and choices that need to be made.

- **Professionally and didactically competent:** Providing a powerful learning environment and promoting learning. → Lessons that are intertwined and follow up on each other so knowledge becomes valuable in the practical skills required for gardening.
- **Organizationally competent:** Providing a clear, orderly, and task-oriented atmosphere and structure in the learning environment. → Clear description of lesson activities.
- **Competent in collaboration with colleagues:** Ensure that the work is in line with other colleagues' efforts; contribute to the good functioning of the school. → See what the students did in the previous years so a streamlined learning curve for the students is ensured.
- **Competent in research:** Organize and guide learning activities with research possibilities for students → Throughout the lessons there are multiple opportunities for students to research different topics and dilemma's

(Faber & Voerman, 2024).

Didactical approach

Didactic coaching

Didactic coaching is a way of interacting between student and teacher. This way the teacher stimulates the student in their reflection process by giving intentional feedback and asking questions. By working this way, the teacher encourages learning and motivates the student. With the help of didactic coaching, a student can acquire insights into their own learning process and into themself. There are two important aspects that play a role:

- The dimension in which the feedback is related to
- The relation between teacher and student

Didactic coaching has four dimensions for giving feedback:

- Content of the assignment: about the content of the produced product
- Learning approach: feedback about the process of learning and self-regulation
- The students learning stage: about the emotions a student is experiencing and to help them regulate those emotions (fear, disappointment, anger, joy, learnersblock)
- Personal qualities of a student: To give specific, positive feedback about the personal qualities a student possesses (perseverance, energetic, helpfulness, adventurousness, joyfullness, bravery) and link it to behavior you enjoy seeing in class.

It is important for these dimensions that the feedback is specific, goal-oriented, and not too long. It is oriented to growth and the further development of the topic.

Didactical approach

One of the ways to give feedback is to ask questions. There are three types of questions, which each have their own role to play.

Type one questions: These are closed questions for verifying information. It is answered with yes, no or facts. Rhetorical questions are also included.

Type two questions: These are questions that concern reasoning regarding content, strategy and the student's learning state. These questions are precisely what gives you as a teacher the opportunity to provide feedback to boost growth.

Type three questions: These questions are for guiding self-regulation, their own learning process, and increasing autonomy and self-reflection. They often concern how students regulate their own learning and their emotions around learning. Questions can be about and for personal qualities, preparations, guidance during learning, and reflection after learning.

While asking questions, there are a few things to think about. First is the waiting time after a question. Give a student at least 8 seconds to hear the question, integrate it, and formulate an answer. If they answer questions very quickly, you can increase the complexity of the questions to keep stimulating growth.

Secondly, when a student gives you an answer. Take that answer to give a follow-up questions (preferably a type two or three question to stimulate reflection or critical thinking) (Faber & Voerman, 2024).

Weekly Lesson Plans

Weekly Lesson Plans

Week	Activity	Skills to aquire	Lesson connection
Week 1	Handling garden tools	- Names of the garden tools - What the garden tools are for	Lesson 1: What does a plant need to grow?
Week 2	Sow the seeds	- Handling seeds with care - Spacing them correctly - The correct depth for the seed - Using potting soil for putting the seeds in	Lesson 2: The seeds of a plant
Week 3	Taking care of the seeds and seedlings	-Caring -Watering -Observing	Lesson 3: Parts of a plant
Week 4 (Dependent on the seedlings. Time from sowing is 1-4 weeks)	Transporting seedlings into bigger pots or into the big garden	- Handling seedlings with care (trying not to break stem or root) - Spacing them far enough apart so they can grow big - Planning where they can go into the big garden	Lesson 4: The roots of a plant
Week 5	Excursion botanical garden for flowering plants (or a walk around town looking for flowering plants)	- Observing different types of flowers - Discovering what pollinators are attracted to which flowers	Lesson 5: From flower to fruit

Weekly Lesson Plans

Week	Activity	Skills to aquire	Lesson connection
Week 6	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants	Lesson 7: Soil and soil animals
Week 7	If seedlings are transported into bigger pots, they can be transported into the main vegetable garden.	-Handling seedlings -Spacing plants -Working with a garden-scoop	
Week 8	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants -Harvesing	Lesson 8: The water cycle
Week 9	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants -Harvesing	Lesson 9: Sun and photosynthesis
Week 10 Start of harvesting some vegetables like lettace	Excursion to the harbor on a Wednesday when the shipments come in (For the two upper clases)		Lesson 10: Local and imported foods
Week 11	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants -Harvesing	Lesson 11: Food waste, compost, nutrient cycle

Weekly Lesson Plans

Week	Activity	Skills to aquire	Lesson connection
Week 12	Excursion to Made in Statia to see all the different plants growing		
Week 13	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants -Harvesing	Lesson 6: Green jobs and future skills
Week 14	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants -Harvesing -Aftercare for the garden	Lesson 12: What part of the plant do we eat?
Week 15	Taking care of the garden	-Caring -Watering -Observing -Tie up tall plants -Harvesing -Aftercare for the garden	Lesson 13: Healthy eating and nutrition
Week 16	Taking care of the garden	-Caring -Watering -Observing -Harvesing -Aftercare for the garden	Reflection on these lessons

Learning goals

Group 1-2

Pupils explore plants, food, and nature through play and sensory experiences, and recognize that plants, animals, water, soil, and sunlight are needed for food to grow

Group 3-4

Pupils understand how plants grow and how food is produced. They show care for plants, soil, water, and living organisms in their environment, like the school garden

Group 5-6

Students investigate how plants grow and how environmental factors like soil, water, sunlight and organisms influence this process. They apply this knowledge in practical gardening activities

Group 7-8

Students analyze how natural systems like plants, soil, water, pollinators and food chains are interconnected. They evaluate sustainable choices in food production and consumption and take informed action in gardening and daily life

Background Information -Gardening

Background Information -Gardening

School gardening helps children understand where food comes from while developing responsibility, cooperation, and sustainability awareness. On St. Eustatius, gardening education is especially valuable because the island climate provides strong sunlight and year-round growing opportunities, while also teaching students about water conservation, soil care, and local food production.

How do you sow seeds?

Sowing begins with healthy soil that is loose and moist. Make a small hole, place the seed inside, cover it gently with soil, and water carefully. Small seeds, such as lettuce or basil, can be sprinkled lightly on top of the soil, while larger seeds, such as beans, should be planted individually.

With children:

- Let younger students use their fingers to make holes.
- Older students can measure spacing and label rows.

How do you know when to sow?

On St. Eustatius, sowing depends mainly on rainfall, heat, and crop type. Fast-growing crops such as lettuce, radish, callaloo, and pak choi grow well during cooler or wetter periods. Heat-tolerant crops such as peppers and sweet potatoes can grow almost year-round.

Background Information -Gardening

Teachers should observe:

- Rainfall and soil moisture
- Temperature
- Amount of sunlight

In these observations, include the students so they learn how to indicate if the conditions are right to sow.
If the conditions are right, it is time to sow.

How deep should a seed be planted?
A general gardening rule is:
Plant seeds about two to three times as deep as the seed is wide.
Small seeds need shallow planting because they require light and have limited stored energy. Larger seeds can be planted deeper.
Examples:

- Lettuce → very shallow
- Beans → deeper holes
- Radish → medium depth

Planting too deep may prevent germination, while planting too shallow may dry the seed out.

Background Information -Gardening

Transplanting Seeds. What is pricking out?
Pricking out means moving seedlings from a seed tray into a larger space so roots can continue growing.

When should seedlings be transplanted?
Seedlings are ready when:

- They have 2–4 true leaves
- Roots begin filling the tray
- Plants become crowded

How do you transplant seedlings?

- Hold seedlings carefully by the leaves, not the stem.
- Make a hole in moist soil.
- Place roots gently into the hole.
- Firm the soil lightly around the seedling.
- Water immediately after transplanting.
- Keep the soil damp for the first few days to ensure that the roots do not dry out.

How do you care for seedlings?
Seedlings need:

- Regular water
- Sunlight
- Protection from strong wind and heavy rain
- Healthy soil

Young plants dry out quickly, especially in the Caribbean climate.

Background Information -Gardening

How do you care for different garden plants?

Different crops have different needs:

- Leafy crops (lettuce, callaloo) need frequent watering.
- Fruit crops (tomato, pepper) need strong sunlight and support.
- Root crops (radish, sweet potato) need loose soil.

Mulching with dry leaves or grass helps keep moisture in the soil and reduces weeds.

How do you know if plants need more or less water?

Signs of too little water:

- Wilting leaves
- Dry, cracked soil
- Slow growth

Signs of too much water:

- Yellow leaves
- Soft stems
- Mold or fungus
- Wet soil for many days

Teach students to touch the soil before watering. If the top layer feels dry, watering may be needed. By letting them see and feel, they will learn to read the signs that plants give.

Background Information -Gardening

When are plants ready to be harvested?

Harvesting is an important step in gardening that directly affects food quality, plant health, and future soil fertility. For you as a teacher, it is essential to understand when and how to harvest and what to do afterward to maintain a healthy growing system.

Fruits and vegetables should be harvested at the right stage of maturity. This is when they are fully developed and ready to eat or nearly ready to ripen further. Signs of ripeness include

- color
- size
- texture
- smell

For example, fruits often develop a bright color and a sweet aroma, while vegetables should feel firm and reach their expected size. Harvesting too early reduces flavor, while harvesting too late can lead to overripe or damaged produce (Boeckmann, 2025).

How to handle plants while harvesting?

When harvesting, it is important to handle plants carefully. Crops should be cut, twisted, or gently picked, rather than pulled or damaged, to avoid harming the plant and reducing future yields. Gentle handling also prevents bruising and decay, which helps maintain food quality (Agriculture Institute, 2025).

Background Information -Gardening

How to take care of the soil after harvesting?

After harvesting, caring for the soil is essential for the next growing season. Plants take nutrients such as nitrogen, phosphorus, and potassium from the soil. To restore these nutrients, organic matter like leftover plant material can be composted and returned to the soil. Compost improves soil structure, increases fertility, and supports soil organisms such as worms and microorganisms, which are essential for a healthy ecosystem.

Additionally, it is important to leave roots in the soil when possible, avoid soil disturbance, and add organic material like mulch or compost. This helps protect life in the soil, prevent erosion, and maintain moisture. Healthy soil organisms break down organic matter and recycle nutrients, creating a continuous cycle that supports plant growth (Barbosa-Cánovas, et all., 2003).

By teaching students how to harvest properly and care for the soil Closing, they learn that gardening is not just about growing food but about maintaining a sustainable system for future harvests.

Background Information -Gardening

Daily tasks

- Check soil moisture
- Water when necessary
- Observe plant growth
- Check for insects or damage
- Remove visible weeds

Weekly tasks

- Add mulch or compost
- Thin, crowded plants
- Tie up tall plants/provide additional support
- Harvest ripe produce
- Record observations in a garden journal (optional → Make a garden journal for the whole class. Get a notebook, and when something is happening, record it in there. This can include sowing dates, transferring, watering, when an insect is found in the garden, how tall the plants are every Monday, and other cool findings.)

Throughout these lessons, encourage students to ask questions, investigate problems, and reflect on their gardening experiences. This helps develop both practical gardening skills and a sustainable mindset.

Lessons

Additional information teacher

Lesson assignments

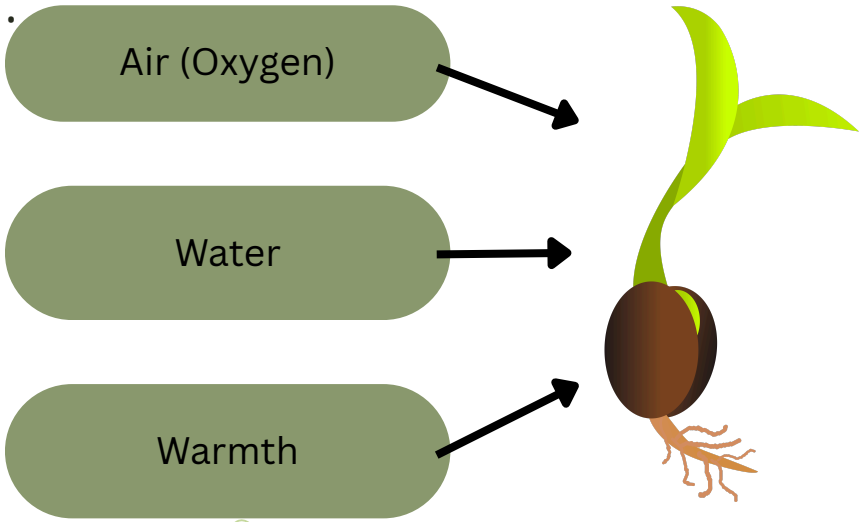
- **Group 1-2**
- **Group 3-4**
- **Group 5-6**
- **Group 7-8**

1 What does a plant need to grow?

Plants on St. Eustatius grow in a warm, tropical environment, but they still need the same basic conditions as plants anywhere else. It is important to understand that a seed (germination stage) and a growing plant have different needs.

First, a seed needs the right conditions to start growing, a process called germination. A seed mainly needs water, air (oxygen), and warmth. Water activates the seed and allows enzymes to start working, so the embryo inside can begin to grow. Air is needed for respiration, which releases energy from the stored food inside the seed. Warmth is important because biological processes happen faster at suitable temperatures. Interestingly, a seed does not always need light or soil (earth) to germinate; it can sprout in moist conditions even without soil because it uses its own stored food at first (Keeley, z.d.; Mischa, 2021).

.

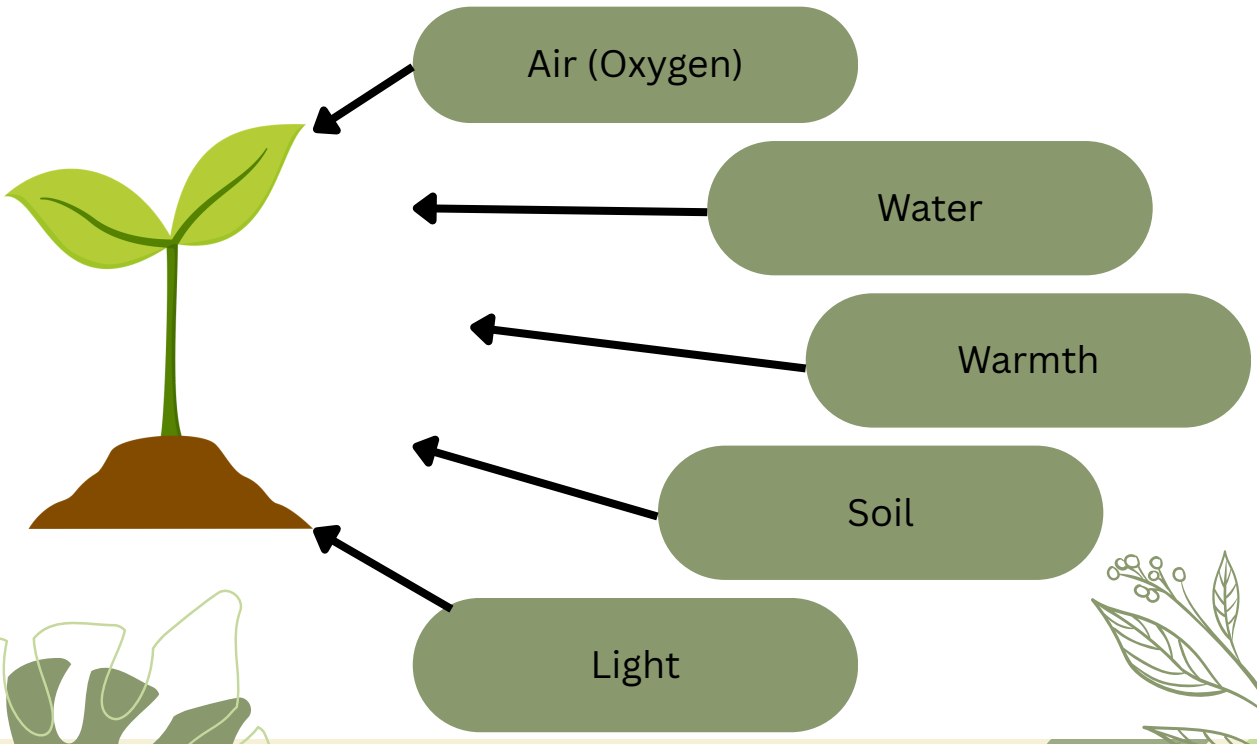


Did you know?

Do you know why plants start to hang when they do not get enough water? The water pressure that they have in their leaves gives them their firmness. When there isn't enough water, they start to droop. A bit like a bicycle tire that does not have enough air and goes flat.

1 What does a plant need to grow?

Once the seed becomes a young plant, its needs change. A growing plant requires light, air, water, warmth, and earth (soil)/nutrient-filled and supportive substrate. Light from the sun is essential for photosynthesis, the process by which plants make their own food. Air provides carbon dioxide, which is also needed for photosynthesis, and oxygen for respiration. Water is necessary to transport nutrients and keep the plant firm and healthy. The earth (soil) provides nutrients and support for the roots, and it also contains air and water spaces. Warmth remains important, especially in tropical climates like St. Eustatius, where higher temperatures can speed up plant growth (IERE team, 2025). In summary, a seed needs water, air, and warmth to start, while a plant needs light, air, water, warmth, and soil to continue growing.



1 What does a plant need to grow?

Group 1-2

Learning goal: At the end of the lesson, you can show what a plant needs to grow.

Video: https://www.youtube.com/watch?v=Cd2O4utPw6c 

<u>The movement game</u>



The pupils play a movement game. They are a seed. The teacher says: water, sun, air, warmth, food. With every element the teacher says, they do a movement. For example, drinking, growing, and shining. During the game you (as a teacher) could ask questions about why they think plants need certain elements

Closing: the teacher asks questions:

- What did you plant need?
- What happens if we forget water?

Group 3-4

Learning goal: At the end of the lesson, you can tell what a plant needs to grow

Video: https://www.youtube.com/watch?v=ZdOmVDRNXys

<u>Experiment</u>



The pupils make three pots with plants or seeds in them. One will be without water and will be in the sun, one will be without sun (in the shadow) but have water, and one will have water and will be placed in the sun. Let the pupils talk about what they think will happen. Let curiosity and research lead.



1 What does a plant need to grow?

Attachment 14 has a sheet where pupils can draw the result of the experiment. Drawing what they see improves the observational skills necessary in research.

Closing: the teacher asks stimulating questions:

- What do you see about the plant in the shadows?
- What do you see and feel about the plant without water?
- What is the difference between the three plants?
- What do you think a plant needs to grow big and strong?

Group 5-6

Learning goal: At the end of the lesson, you can explain what a plant needs to grow.

<u>Set up an experiment</u>

The teacher asks them what they think a seed needs to sprout. The pupils answers. With these answers, they will make different pots with seeds to try out the answers (examples of answers are air, soil, sun, warmth, and water). Let them set up the experiment and follow what happens with the different cups. The important part is to follow the curiosity and research skills of the pupils.

Closing: Make a conclusion based on the experiment by asking questions:

- What happened with the different cups?
- What are the differences in what you feel on the leafs?
- What are the differences in what you see on the plants
- What does that tell us about the needs of a plant?

1 What does a plant need to grow?

Group 7-8

Learning goal: At the end of the lesson, you can explain what a plant needs to grow and know when to adjust the variables if a plant does not grow.

Set up an experiment

The teacher asks them what they think a seed needs to sprout. The pupils answers. With these answers, they will make different pods with seeds to try out the answers (examples of answers are air, soil, sun, warmth, and water). Let them set up the experiment and follow what happens with the different cups. The important part is to follow the curiosity and research skills of the pupils.





After two weeks, when the plants are bigger, they will be transported into bigger pots. The pupils will try to even out the variables and give them all the best chance. The importance is observing and understanding what they see and what needs to be done to support the plant (understanding and action skills)



Closing: Make a conclusion based on the experiment by asking questions:



- What happened with the different cups?
- What are the differences in what you feel on the leafs?
- What are the differences in what you see on the plants
- What does that tell us about the needs of a plant?
- How can you tell what a plant is missing or has too much of?
- What do you need to do when a plant is giving signals of lacking an important element for their growth?

2 The seeds of a plant

Seeds are the starting point of most plants on St. Eustatius, from mango trees to small garden vegetables. They come in many different shapes, sizes, and types, but they all have the same main function: to grow into a new plant.
There are different types of seeds. Some are large and easy to see, like mango or tamarind seeds, while others are very small, like those of grasses or herbs. Seeds can also be grouped by how they spread. For example, some seeds are carried by wind (light seeds), some by water (important on islands like St. Eustatius), and others by animals, such as birds or goats that eat fruits and spread the seeds through their droppings (Bewley et al., 2013).
Seeds come from flowers. After pollination and fertilization, the flower develops into a fruit, and seeds develop within the fruit . This means that fruits like papayas, tomatoes, and mangoes all contain seeds that can grow into new plants.



(Will, 2021)


(My-permaculture, 2018)



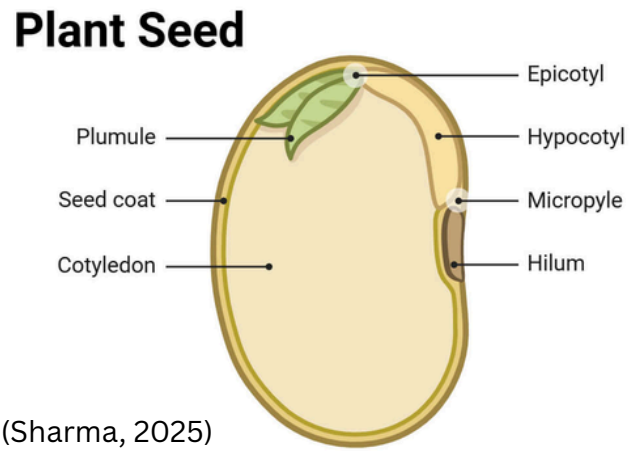
(Home Learning, 2020)

2 The seeds of a plant

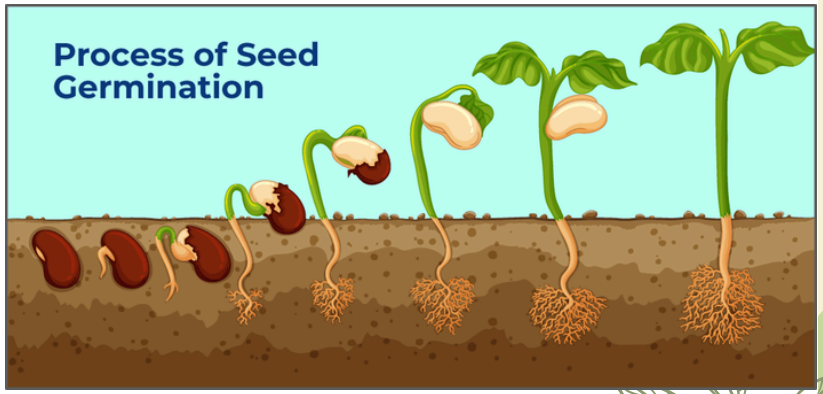
Most seeds have three main parts. The first is the seed coat, a protective outer layer. The second is the embryo, which is the tiny baby plant inside. The third is the food store (called the endosperm or cotyledon), which provides energy for the embryo when it starts growing. In larger seeds with two cotyledons, like beans, you can often see these parts with the naked eye when you open them (split them down the middle). In very small seeds, you usually need a microscope to see them clearly (Chaffey, 2014). From these three parts grow the root and the first leaves.

Seeds grow in a clear sequence. First, the seed absorbs water, which activates growth. Next, the seed coat breaks open when the root (radicle) grows downward into the soil to take up water and nutrients. After that, the shoot grows upward toward the light. Finally, the first leaves open and begin photosynthesis, allowing the plant to make its own food.

In summary, seeds develop inside fruits that developed from flowers Seeds contain a small plant inside, and grow step by step into a new plant when conditions are right.



(Sharma, 2025)



(Indiana native plant society, z.d)

2 The seeds of a plant

Group 1-2

Learning goal: Pupils recognize that seeds come in different shapes and sizes and grow into plants

<u>The world of seeds</u>



Bring different types of seeds to the classroom. Examples are coconut, mango, papaya, banana, tomatoes, lettuce, and grasses. The pupils look for differences and similarities between the seeds. The goal is to experience and feel the different seeds



Closing: questions to think about:

- Which seed did you like the most and why?
- What do you think will happened to your seed?
- Do we remember what a seed needs to grow from lesson one?



Group 3-4

Learning goal: Pupils can name the basic parts of a seed and explain their function in simple terms.

<u>The inside of a seed</u>



Before the seeds are cut open, ask the pupils what they think is inside the seed. Let their imagination play a role in this exploration. The teacher or pupil cuts/splits open a seed (beans for example) and looks what is inside. They look for the seed coat, embryo, and food. Then draw what they see.





Interactive animation of how a seed germinates: https://curious.science.org.au/earth-environment/plant-germination.com



2 The seeds of a plant

Closing: questions to think about:



- What did you think you would find in the seed? Do you see that?
- What surprised you inside the seed?
- Why is the inside important for growth?

Group 5-6

Learning goal: Pupils can describe the stages of seed germination.

Video of seed germination: https://www.youtube.com/watch?v=TE6xptjgNR0

<u>The inside of a seed</u>



The students now know different parts of the seed. Now they are putting that knowledge into practice. There are different seeds on the table. The pupils will cut open the seeds and see if they can find all the parts of the seeds in the different seeds on the table.





They choose a seed and draw the process of germination in a comic strip with the steps written down below the drawings.



Closing: questions to think about:



- Do you see all the different parts of the seeds in all the seeds that were on the table?
- Why does the root grow before the leaves?
- Do you think it matters how the seed is planted? (upright or upside down) → Why do you think that?



2 The seeds of a plant

Group 7-8

Learning goal: Students can explain the germination process and design a seed with a dispersal strategy adapted to its environment.

Video seed germination: https://www.youtube.com/watch?v=8z9mQycA4Og
Quiz about seed germination: https://www.youtube.com/watch?v=Rdq8Wf2lJQs
Show the first video. Let the pupils ask questions if they have them. Then test if they remember what was told by doing the quiz. Give them a little chalkboard/whiteboard or paper to write down their answers. Reflect on their answers. If they are incorrect, ask them why they thought it was that answer. If they need extra explanation, ask a peer if they can explain it. That way they can integrate the knowledge.





<u>The perfect seed</u>
Seeds may have everything they need, but if they are not in the right place, they will not germinate.
Question: What are ways for a seed to get to the right location?
Assignment: Design the best seed for Statia with the transportation that is the most adapted to the environment. Present it to the class and explain why it is the best seed.





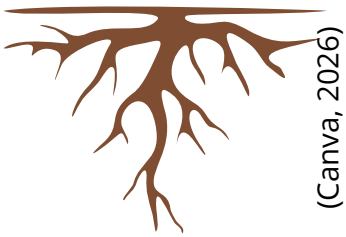
Closing: questions to think about:

- Why is your seed successful on Statia?
- What would happens if conditions change?
- Does your seed also work in a different country? Why yes or no?

3 Parts of a plant

Plants on St. Eustatius, such as mango trees and garden crops, are made up of different parts that each have a specific function. Together, these parts help the plant grow, survive, and reproduce.

The root grows below the ground. Its main functions are to anchor the plant in the soil and to absorb water and nutrients. Roots also often store food. From the root, water and minerals move into the plant through special transport systems (xylem).



(Canva, 2026)

The stem grows above the ground and supports the plant. It holds the leaves up toward the light and connects all parts of the plant. Inside the stem are the transport systems: the xylem, which carries water and nutrients upward, and the phloem, which transports sugars made in the leaves to the rest of the plant.



(Canva, 2026)

The leaf is where the plant makes its food through the process of photosynthesis. Leaves use sunlight, air (carbon dioxide), and water to produce sugars. They also have tiny openings called stomata, which allow gas exchange (taking in carbon dioxide and releasing oxygen).



(Canva, 2026)

3 Parts of a plant

The flower is responsible for reproduction. Inside the flower, pollen and ovules are formed. After pollination and fertilization, the flower can develop into a fruit with seeds. A flower bud is an early stage of the flower. It protects the developing reproductive parts before the flower opens.

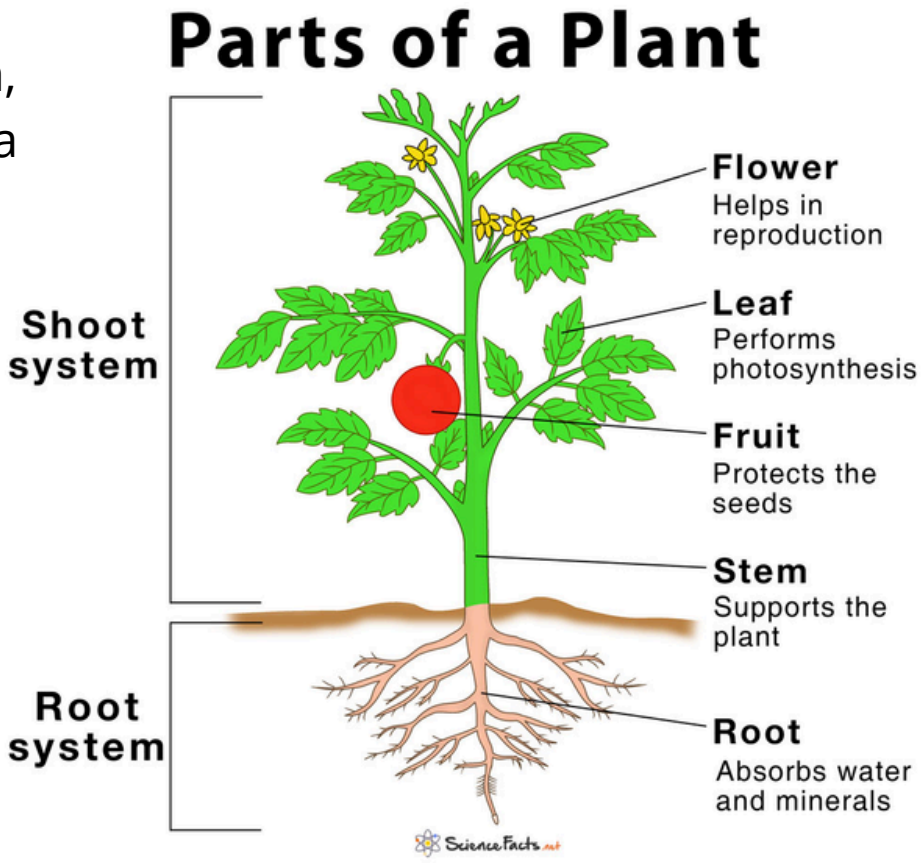


(Canva, 2026)

Plants develop in a clear order. First, the roots grow downward to find water. Then the stem grows upward, followed by the leaves, which start producing food. Finally, the plant forms flower buds, which grow into flowers for reproduction.

In summary, each plant part—root, stem, leaf, and flower—has a specific role, and all parts work together through transport systems to keep the plant alive and growing.

Additional information: https://www.geeksforgeeks.org/biology/parts-of-plants/



3 Parts of a plant

Group 1-2

Learning goal: Pupils recognize basic plant parts.

Video growth of a bean in 25 days:
https://www.youtube.com/watch?v=w77zPAtVTuI



Seeing, feeling, and smelling



In the classroom are the parts of different plants. Some plants are whole with every part on them. For others there are only parts (leaves, flowers, stems, roots, or fruits). The pupils look at the different parts, feel them, and smell them. The teacher asks if they know what the different parts are named. Let curiocity be the lead. When they know which part is what, they can mimic the different parts. Roots are low, the stem is straight up, the leaves move on the branches (example: arms), and the flowers open and bloom. Let them be creative, and let them dance out the growth of a plant.







Closing: Questions to ask

- What is your favorite part of the plant?
- Does the plan need all parts?

Group 3-4

Learning goal: Pupils can name plant parts and explain their basic function

Matching



The students get attachment 1 (it can be individual, in groups of two or more. The form can also be cut out and placed as a puzzle). They carry out the assignment. When they do not know the answer, give

3 Parts of a plant

them guiding questions that help them understand what the puzzle solution could be. Those are questions like:

- What do you think?
- What can you put into place? And what cards are left?
- What could you do if you feel stuck? → Ask a peer

That way they get to the answer themselves and they follow the entire process of understanding what the parts are called and what they are for.

Video to get them to check their own answers:
https://www.youtube.com/watch?v=p3St51F4kE8

Closing: Question to ask

- What was the hardest to put in the right place?
- Which part of the plant is the most important and why? (All are important for long-term survival)
- What would a plant look like if it did not have all the parts?



Group 5-6

Learning goal: Pupils can recognize and name the parts of a plant on different species and explain what function they serve.

Video about different parts of the plants:
https://www.youtube.com/watch?v=flA57wFCOPA

<u>Draw what you see</u>

In the classroom there are different plants present. These plants have some or all of the parts on them (roots, stem, leaves, flowers, fruits, seeds). The children will feel them, smell them, and look at how the plants are built up. They choose one specific fruit of vegetable.

3 Parts of a plant

that they get to draw. They draw the different parts of the plant and write the name of the part of that plant. Then they draw and write the function of that part.
Closing, they compare their drawings of that specific plant with the drawings of another plant. Let them find the similarities and differences.

Closing: Questions to ask

- What part of the plant comes first? Which second? Etc..
- What similarities did you see?
- Did you notice any differences? (Could be the shape, color, or size of the leave, flower, and root) Why do you think that is?

Group 7-8

Learning goal: Pupils can explain the functions of plant parts and what they look like on the inside.

<u>What is inside?</u>

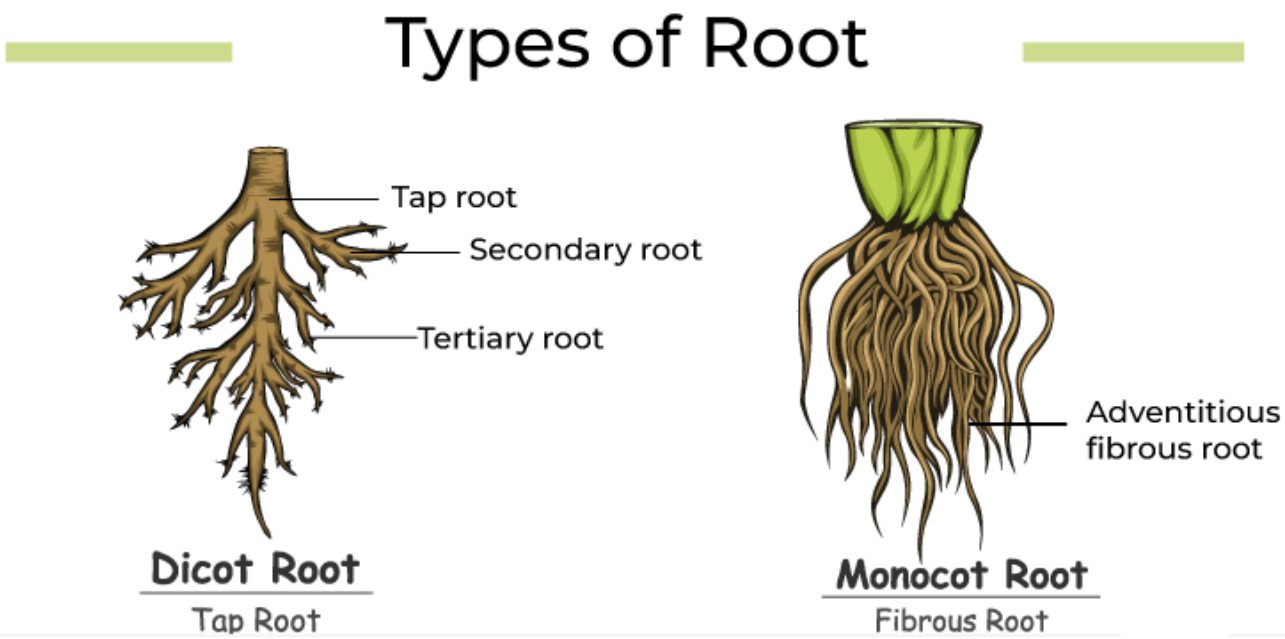
The teacher shows a plant in the classroom and asks if anybody knows what the different parts are called. The teacher is a coach and will only ask questions that guide them in the right direction. Once they figure that out, they get to investigate what the different parts are used for and what that looks like. They do this by cutting open the different parts. They look at the color, structure, what part of the plant they are, and what they feel like. They draw and write that down on attachment 2.

Closing: Questions to ask

- Are there differences between different plants?
- What part surprises you the most?
- What is something new you learned today?

4 The roots of plant

Plants and trees on St. Eustatius grow in different environments, from dry rocky hills to moist gardens. Because of this, they have developed different types of roots that help them survive.
The most common type is the taproot system. This is one thick main root that grows deep into the soil, with smaller side roots branching off. Trees like tamarind often have taproots. These roots are very good at reaching water deep underground, which is important during dry periods.
Another type is the fibrous root system, made up of many thin roots that spread out near the surface. Grasses and many crops have this type. These roots are good at quickly absorbing water when it rains (Raven et al., 2013).



(Geeks for geeks, 2025-b)

4 The roots of a plant

Some plants have special roots that grow in unusual places. Aerial roots (luchtwortels) grow above the ground. These can be seen in some tropical plants and help absorb moisture from the air or provide extra support. Prop roots, for example, grow from the stem into the soil to hold the plant steady in windy conditions. There are also storage roots, like sweet potato, which store extra food for the plant (Taiz et al., 2015). Another important type is the rhizome (wortelstok). This is a stem that grows underground and can produce new shoots and roots. Plants like ginger spread this way, allowing them to grow across an area.

All roots have important functions. First, they absorb water and nutrients (such as nitrogen and minerals) from the soil. These are transported to the rest of the plant through the xylem. Second, roots anchor the plant firmly in the ground. Third, many roots store food, which helps the plant survive dry periods or regrow after damage.

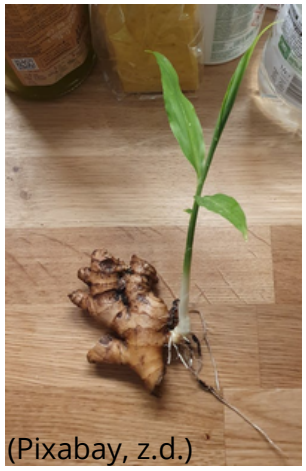
In summary, roots come in many forms—deep, shallow, above ground, or underground—but they all help the plant take in nutrients, stay stable, and store energy for growth.



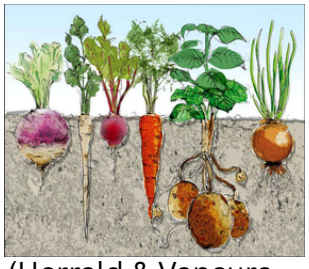
(Pexels, z.d.)



(Pixabay, z.d.)



(Pixabay, z.d.)



(Herrald & Vancura, 2016)

4 The roots of a plant

Group 1-2

Learning goal: Pupils recognize that roots grow underground and help plants drink water.

Root paintings

Get white paint and water that down a bit. Take a dark sheet of paper and a straw. Tilt the paper a bit, place a drop of watered-down paint on middle of the paper, and blow the drop with the straw to 'create roots'.
Let them draw the plant or tree on top of the root. There can be multiple plants with roots next to each other.



Closing: Questions to ask

- What shape does your root have?
- Does your root drink water from the upper levels of the ground, or does it drink deep water?
- How many small roots does your drawing have?





Group 3-4

Learning goal: Pupils can distinguish between different types of roots and their basic functions.

Categorizing the roots

In attachment 3 are photos of different types of roots. They each serve a main function, either water absorption, storage, or anchoring the plant
Match the right root to the main function. Each root carries out all the functions for survival, so there is no wrong answer. The roots may have a main function that is more obvious.





4 The roots of a plant

Closing: Questions to ask

- Are there any roots you were unsure about? Why?
- Are there plants you recognized?
- Do you think some roots are edible?

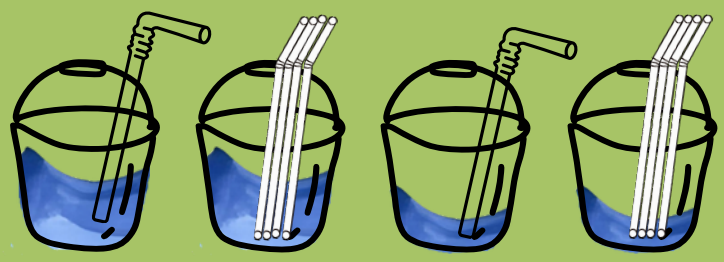
Group 5-6

Learning goal: Students can explain how different root types absorb water in different ways and why that is important.

Video: https://www.youtube.com/watch?v=aNmZOJHuf3k

<u>What roots work best</u>

There are four buckets of water on one end of the classroom (or outside). Two of them are half full with water, and the other two only have a little bit of water at the bottom. In one half full bucket goes a thick straw, and in the other go a few very small straws. On the other end of the classroom are four empty buckets.
The students now transfer the water that is in the buckets to the empty buckets on the other side. Do this for a fixed amount of time. When the timer goes off, everybody stops, and you can see which straw transferred the most water.
Beforehand, let them make predictions of which straw will transfer the most amount of water.



4 The roots of a plant

Closing questions to ask:

- Was your prediction correct?
- What did you learn about roots?
- What does this say about the way roots drink water differently?
- What could be your conclusion (in your own words)?

Group 7-8

Learning goal: Pupils can analyze environments and make decisions about which roots would be most suitable for plant survival.

Case study

There are 8 cases (attachment 4) with a description of a climate. It is up to the student to connect the right root to the right climate description. Cut out the individual cards so they can puzzle in duos and then compare their answers and have a conversation about why answers could be different from each other.

As a teacher, you observe the first few minutes and then start walking around. Do not give them the answer, but coach them toward it. Ask questions:

- Why do you think that?
- What root system could be a solution to the main challenge?
- Does the context match your choice of root?
- Which connections can you make, and what cards are left? → Does that make sense?

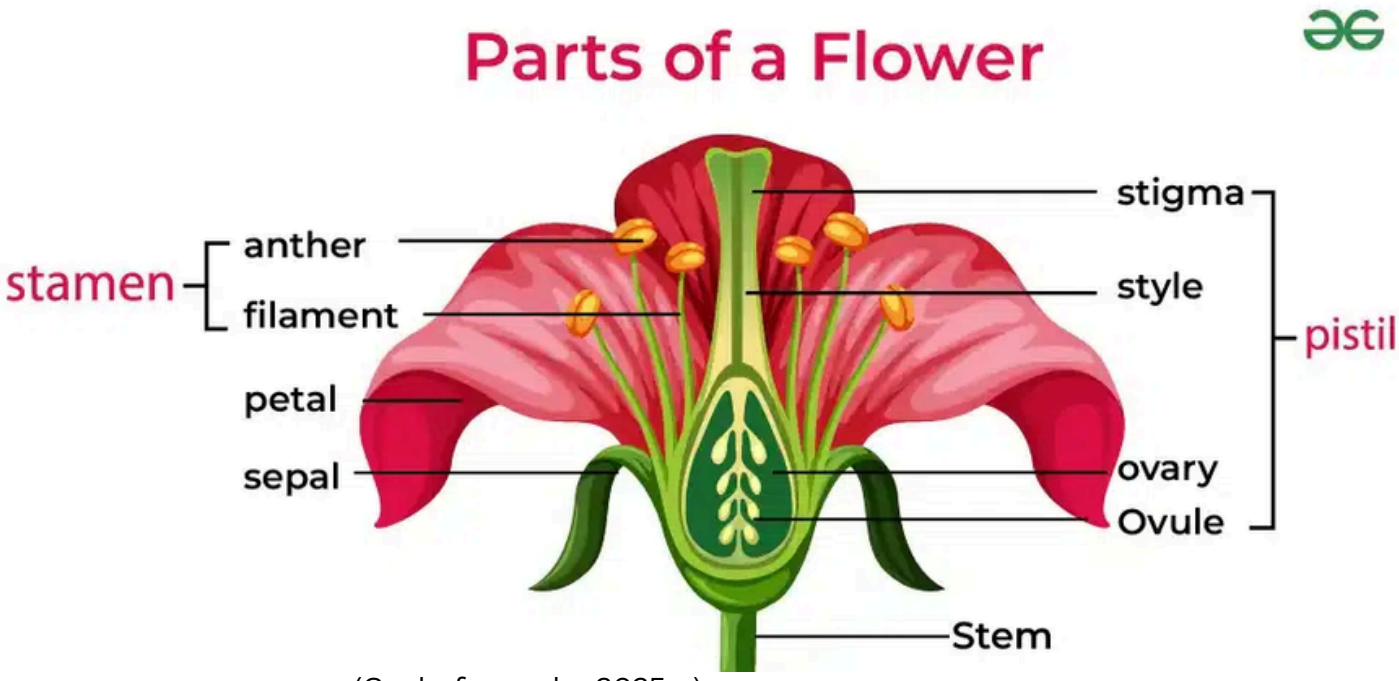
Answers:
Case 1 = D
Case 2 = H
Case 3 = C
Case 4 = G
Case 5 = A
Case 6 = F
Case 7= B
Case 8 = E

Closing:

- What root systems would be suitable for our school garden? And why?
- What root systems surprised you the most?
- What roots do you think the plants in your garden have?

5 From flower to fruit

The process from flower to fruit is an important part of how plants reproduce on St. Eustatius. Many local plants, such as mango, papaya, and passionfruit, depend on this process to produce food.
A flower (bloem) contains the reproductive parts of a plant. The main parts are the stamen (male part), which produces pollen, and the pistil (female part), which contains the ovary with ovules. Around these are the petals, which attract pollinators, and the sepals, which protect the flower bud before it opens (Chaffey, 2014).



(Geeks for geeks, 2025-a)

5 From flower to fruit

The process begins with pollination, when pollen is transferred from the stamen to the pistil. This is often done by pollinators. On St. Eustatius, common pollinators include bees, butterflies, moths, birds, and even bats. Bees visit flowers for nectar and pollen, butterflies are attracted to bright colors, and bats pollinate flowers that open at night.



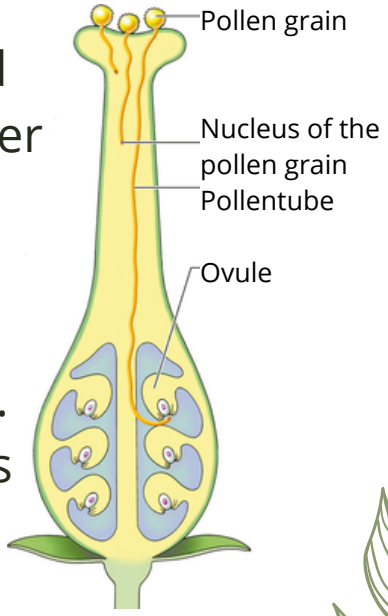




Flowers are often shaped to match their pollinators. For example, bright, open flowers attract bees and butterflies, while long, tube-shaped flowers are suited for birds with long beaks, like hummingbirds. Strong-smelling, pale flowers often attract bats or moths at night. This relationship between flower shape and pollinator helps ensure successful pollination.

After pollination, fertilization occurs. The pollen travels down to the ovary and fertilizes the ovules. These ovules develop into seeds, and the ovary grows into a fruit. For example, after pollination, a mango flower develops into a mango fruit containing a seed.

In summary, the process from flower to fruit involves pollination, fertilization, and growth. Pollinators play a key role, and flower shapes are adapted to attract them, ensuring that plants can reproduce successfully.



(Schouten Biologie, z.d.)

5 From flower to fruit

Group 1-2

Learning goal: Pupils understand that pollinators help flowers become fruits.

<u>Helping with pollinating</u>

There are different flowers (attachment 5) in the classroom. The pupils are the pollinators. They get to choose if they are a bee, butterfly, bird, or bat. They fly from flower to flower with the pollen (colored circles or cotton balls) to help the flowers grow into fruits (attachment 5)

As a teacher, you can spark their curiosity by asking questions

- Why do you think bees fly from flower to flower?
- Are all flowers the same?
- How many flowers do you know?

Closing:

- What did you do as a pollinator?
- What happens if there are no pollinators?

Group 3-4

Learning goal: Pupils can describe the steps from flower to fruit in the correct order.

<u>Once upon a time...</u>

Every duo gets a stack of cards (attachment 6). The cards have pictures of flowers, pollination, fertilization, growing, and fruit. The goal is to put them in the right order and make a story with it. They can either draw or write the story (or a combination).

5 From flower to fruit

Closing, questions to ask:

- Which step did you find most important?
- What would happen if one step were missing?

Group 5-6

Learning goal: Students can explain how flower characteristics match with specific pollinators.

Video about pollination: https://www.youtube.com/watch?v=Dfvyoir_SCY

<u>Match the pollinator</u>

The students get pictures of different types of flowers. On the other hand, they get pictures of different pollinators. The goal is to match the flower to the right pollinator. They have to give an explanation why they think it is the right match. They can explain things like color, shape, smell, and time of blossoming.
(attachment 7)

Closing questions:

- Why did your match work?
- Would another pollinator also work? Why yes or no?
- What would happened if a pollinator went extinct?s

5 From flower to fruit

Group 7-8

Learning goal: Students can analyze the role of pollinators in ecosystems and propose solutions when the system is disrupted.

Video about pollination: https://www.youtube.com/watch?v=Dfvyoir_SCY → same as group 5-6 to understand pollination
In-depth video fertilization: https://www.youtube.com/watch?v=8Y5BRMCo-00

<u>What if...</u>
What if pollinators disappear on Statia? What will happen?
The students work in groups on the consequences when pollinators disappear. Then they will work on solutions. How do we solve those problems, and how can we prevent the consequences? They can make a poster with two sides to present. On one side the consequences and on the other the solutions and future adaptations to ensure the survival of pollinators.
If there are multiple groups, they could each get a pollinator group to sort out (birds, bees, butterflies, bats).
To let the other students engage during the presentation, let each of them write down a question they have to ask Closing.

Afterword questions to ask:

- What is your responsibility in protecting pollinators?
- What action could you take one day of the weekend to help the pollinators?
- What could we do in and around the school to help the pollinators? → If they come up with doable ideas, do at least one. This shows that they have an impact on the environment and can make a difference.

6 Green jobs and future skills

Green jobs are occupations that contribute to protecting the environment, supporting sustainable food systems, and building resilient communities. In the “farm-to-plate” cycle, many green jobs are connected to how food is grown, transported, prepared, and recycled. Teaching children about these careers helps them understand sustainability and prepares them for the future.
Examples of green jobs in the food system include farmers, gardeners, and agricultural workers, who grow crops and care for the soil. Fishermen and marine biologists help protect marine ecosystems and ensure fish populations remain healthy for future generations. Nature conservationists work to protect biodiversity, forests, pollinators, and natural habitats, which are all essential for healthy ecosystems and food production. Other jobs include chefs, nutritionists, market sellers, and transport workers, who help bring food from farms to consumers.

Green innovation is also becoming increasingly important. Careers in renewable energy technology, such as solar panel engineers and wind energy technicians, help create cleaner energy systems that reduce pollution and climate change. On sunny islands like St. Eustatius, solar energy technology can support more sustainable farming and food production systems.

6 Green jobs and future skills

Gardening lessons provide an ideal opportunity to develop important future skills that children need to thrive in a rapidly changing society. You as a teacher can intentionally support these skills by giving students meaningful responsibilities and encouraging inquiry-based learning. For example, collaboration can be stimulated by letting students work in small groups to care for a garden bed, solve problems together, and divide tasks. Critical thinking develops when students are asked open-ended questions such as: “Why do you think this plant is not growing well?” or “What could happen if we forget to mulch the soil?” See the didactic coaching in the didactical approach for more guidelines in giving feedback and asking questions that stimulate critical thinking.

Creativity and problem-solving can be encouraged by allowing students to design planting layouts, invent watering systems, or think of sustainable solutions for reducing waste in the garden. Communication skills are strengthened when students present observations, explain choices, or reflect on their gardening experiences. Responsibility and perseverance are developed through regular care routines such as watering, weeding, and monitoring plant growth over time.

6 Green jobs and future skills

These skills are important because future societies increasingly require people who can adapt, think sustainably, work together, and solve complex environmental challenges. Gardening naturally connects children to systems thinking by helping them understand the relationships between food, soil, water, climate, waste, and health. By linking gardening to green careers and future skills, teachers help students understand that sustainability offers opportunities for meaningful work, innovation, and caring for people and nature (OECD, 2018; UNESCO, 2017).





6 Green jobs and future skills



Group 1-2

Learning goal: Pupils recognize that different people help care for plants, animals, food and nature

Acting out jobs

Everybody stands in a circle. The teacher names a (green) job. The pupils have ten seconds to think of a motion that that person performs on the job. Then they act out the motion. As a teacher, you ask what movement they are doing. Why are they doing that movement? How does it correspond to the job? Do this multiple times. Once they get the idea, let the pupils come up with jobs they know.

Examples of (green) jobs

- Fisherman
- Farmer
- Nature ranger
- Marine biologist
- Chef
- Truck driver
- Goat keeper
- Electioneer
- Baker

Closing question:

- What new job did you learn today?
- What was your favorite movement? Why?
- Which job would you like to do when you grow up?
- How does this job help nature or people?

6 Green jobs and future skills

Group 3-4

Learning goal: Pupils understand that different jobs include different tasks.

Memory



In attachment 16 is a memory sheet that can be printed out. The students will match the job to the right task. They can compete with each other or work in teams to match everything. As a teacher, your job is to guide them into understanding that all the jobs in the pictures do different tasks. Do that by asking questions to spark their curiosity and let them ask questions. Do not answer their questions right away, but let them think for a moment. Ask what they think.



Closing, questions:

- What is your favorite job?
- What does a farmer (or other worker) do in a day?
- What is a job that helps nature? Why?

6 Green jobs and future skills



Group 5-6

Learning goal: Students understand that many jobs are connected to nature and sustainable living

<u>Who am I?</u>

In attachment 17 are cards where the students can write different jobs on. These jobs will be part of a “Who am I” game. They pic a job card, and bind them on their forehead. By asking questions, they have to guess the job. It can only be questions that are answered with yes or no. There is no limit to the amount of questions. Once they guess it, another student picks a card and plays the game.
Examples of jobs are:

- Farmer in agriculture
- Goatkeeper
- Fisherman
- Environmental scientist
- Compost worker
- Solar engineer
- Green architect
- Ecologist
- Recycling manager
- Marine biologist
- Coral maintainer
- Terrestrial maintainer

Closing questions:

- How would these jobs help live sustainably?
- What job do you see yourself in?
- What is a job that hasn't been named yet but is important in providing food for people?

6 Green jobs and future skills



Group 7-8

Learning goal: Student can describe their dream job and make an action-build plan to get there

My dreamjob

The students will make an action build plan to get to their dream job. To get here, there are the following steps to undertake.

1) Think of a dream job (it does not have to exist at the moment)
2) Describe what the tasks would be for that job. What do you do? Who do you work with? What are you wearing?
3) What would a day or week in the life of that person look like? Draw, write, or visualize it in a way
4) What skills does this person have to do the job?
5) What skills do I have that support this job, and what skills do I need to develop?
6) How can I develop these skills? What do I need to do?
7) What can I do today, this week, this month, and this year to get one step closer to my dream job? → Write this down!
8) Make a calendar or write it down in one, so the plan becomes action. Track your process by revisiting your calendar weekly and making notes.

Closing questions:

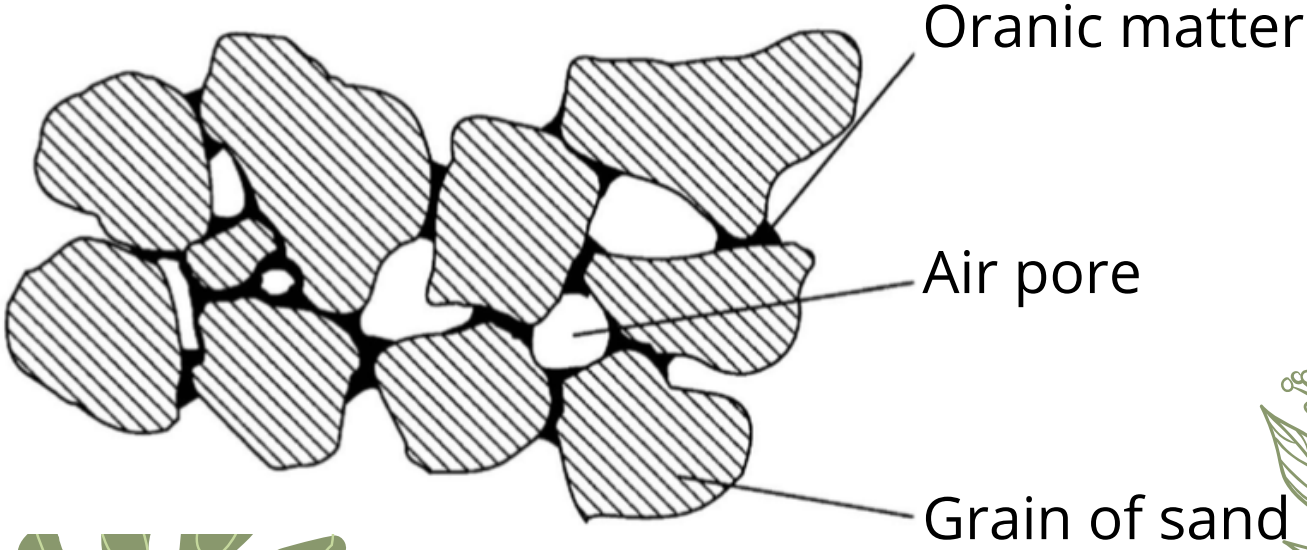
- Why did you choose that dreamjob?
- What can you do this week to get one step closer?
- How can you make sure to stay on track in developing the skills required for this job?
- What can you do in the school garden that will help you with this skill? (Teamwork, communication, handling tools)

7 Soil and soil animals

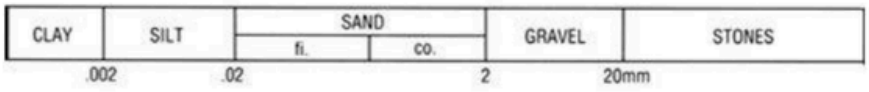
Soil on St. Eustatius is often volcanic, which makes it unique and important for plant growth. There are different types of soil, and each type affects how plants grow, especially their roots and access to water.

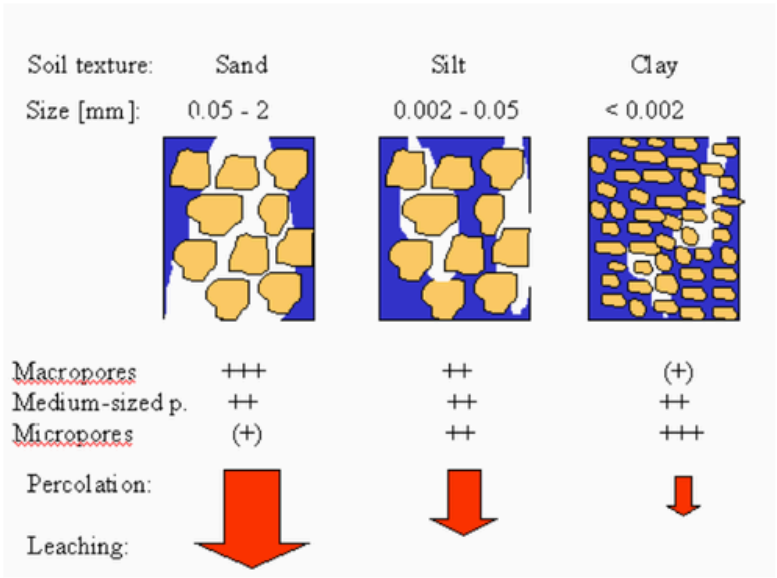
The main soil types are sandy soil, clay soil, and loamy soil. Sandy soil has large particles and feels gritty. Water drains through it very quickly, which means roots may not get enough water or nutrients. Plants growing in sandy soil often develop deep or wide root systems to find water (USDA, z.d.). Clay soil has very small particles and feels sticky. It holds water well, but it drains slowly. This can cause problems because roots may not get enough oxygen. In wet clay soil, roots can struggle to grow or even rot.

Loamy soil is a mix of sand, clay, and organic matter. It has good drainage but also holds enough water and nutrients. This is the best type of soil for most plants because roots can grow easily and get what they need.

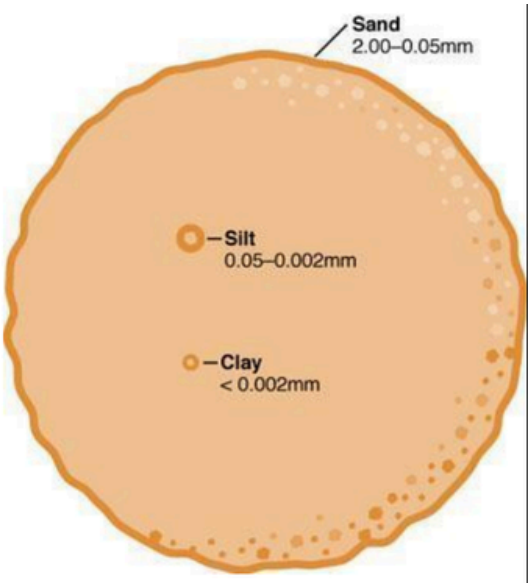


7 Soil and soil animals





(Pearson, z.d.)





Soil also contains many unique animals that are very important for plant health. For example, earthworms dig tunnels that improve drainage and airflow, helping roots grow better. Small organisms like bacteria and fungi break down dead plants and animals into nutrients that plants can absorb. Other animals, like insects, help mix the soil and spread organic material (Brussaard et al., 2007).





(Pexels, z.d.)

7 Soil and soil animals

The organic matter in the soil is made up of decomposed plant residue and animal waste. This is being processed by the organisms in the soil, which include worms, bacteria, fungi, and nematodes. When the organic matter is well-decomposed, it is called humus. The key functions of humus are:

- Nutrient Supply: It serves as a reservoir for nutrients, releasing nitrogen (N), phosphorus (P), and sulfur (S) through decomposition, which are then used by plants.
- Water Retention: Organic matter acts like a sponge, holding up to 90% of its weight in water, which reduces vulnerability to drought.
- Soil Structure Improvement: It helps bind soil particles together, improving soil structure, reducing compaction, and increasing water infiltration.
- Erosion Control: By increasing soil stability and water infiltration, organic matter reduces erosion.
- Carbon Storage: Soils store carbon (as organic carbon), making the management of soil organic matter critical for mitigating extra atmospheric carbon dioxide.

Healthy soil is full of life. These soil animals create a system where nutrients are recycled, water moves more easily, and roots can grow strong. Without them, soil becomes compacted and less fertile.

In summary, different soil types affect how water moves and how roots grow, while soil animals play a key role in keeping the soil healthy and supporting plant life.

7 Soil and soil animals

Group 1-2

Learning goal: Pupils recognize that soil is different and contains living animals.

<u>Soil sensory play</u>

There are three (or more) different trays of soil in the classroom. Each of these trays contains a different type of soil (sand, clay, garden soil, loam, or silt). The pupils put their hands in and feel the soil. They knead the soil, smell it. You could add water to see what happens. They experience the differences. You could add worms to the soil to teach them about the animals that live in the soil.
As a teacher, you ask questions and do not interfere with their sensory play:

- What do you feel?
- What do you see?
- What can you make with it?
- Do you see animals in the soil

Closing:

- Which soil did you like most?
- What animals can live in the soil?
- Have you ever seen an animal in the soil?

Group 3-4

Learning goal: Pupils understand that soil is made of different layers and supports life.

Video about soil and the different layers:
https://www.youtube.com/watch?v=-6BaL-VV1wA

7 Soil and soil animals

I got a jar of dirt

To learn about the different layers in the soil, the pupils make a layered jar in which they replicate the layers that are in the soil. They start with bigger rocks, then smaller rocks, a lighter-colored soil or sand, a darker-colored soil or rich compost, and then a layer of fresh organic material like small sticks and leaves.



Closing questions to ask:





- What will happen with the organic matter?
- What would make your soil healthier?
- How can you take care of your soil?

Group 5-6

Learning goal: Students can explain how different soil types affect water drainage and root growth.

Video instruction experiment for teachers:
https://www.youtube.com/watch?v=CBmDlbFOZKU

Website with instruction on the experiment:
https://agclassroom.org/matrix/lessons/147/



Video student: https://www.youtube.com/watch?v=Q-J2FErZHuA

Soil drainage testlab



The students set up an experiment to figure out the effect of the different types of soil on water drainage. There will be at least three bottles, each with different soil types. Then the dirty water is poured into each bottle. They measure how long water takes to run

7 Soil and soil animals

through, how much water goes through, and how dirty the water is that comes out.
Options for types of soil in the bottles are: sand, clay, organic matter or rich organic soil, sand with plants in them, clay with plants in them, organic soil with plants in them, a mixture of sand and clay, volcanic soil, small rocks (gravel), and schoolyard soil.

Closing: Questions to ask:

- Which soil works the best for plants and why?
- What could be an explanation for the difference in time?
- What type of soil do you think the schoolyard has based on these results?
- Why do some places have puddles after it rains and others don't?





Group 7-8

Learning goal: Students can analyze soil and determine the right vegetables for it to grow on.

Video: https://www.youtube.com/watch?v=PvN_oWoechg&t=329s

<u>What soil do we have?</u>



There are five jars in the classroom with soil from five different locations. For example:

- Zeelandia beach
- Boven national park
- Quill
- School playground
- Beach at Scubaqua

This soil comes from 5-15 cm deep and has no big pebbles and organic matter.

7 Soil and soil animals

Each jar is filled halfway with soil from one of the places. Add a drop of dishwashing liquid, then fill it with water to 90% of the jar. Put a lid on it and shake for 3 minutes. After that, set it on a counter and wait for a day. After a day you can see the different settlements.
The big/heavy particles dropped first, so they will be at the bottom. The higher the soil is in the jar, the lighter and smaller the particles will be. Organic matter will floating on top of the water.
See attachment 15 for visualization and a calculator to determine soil type.
The students will determine what type of soil this is and then research what vegetables can grow on it.
The students will take the lead in this research. Provide the materials and show the instruction video. The rest is up to the students. It is okay if they try and fail. You can ask open questions to stimulate reflective thinking, but refrain from telling them what to do.
Let them present their results to each other.

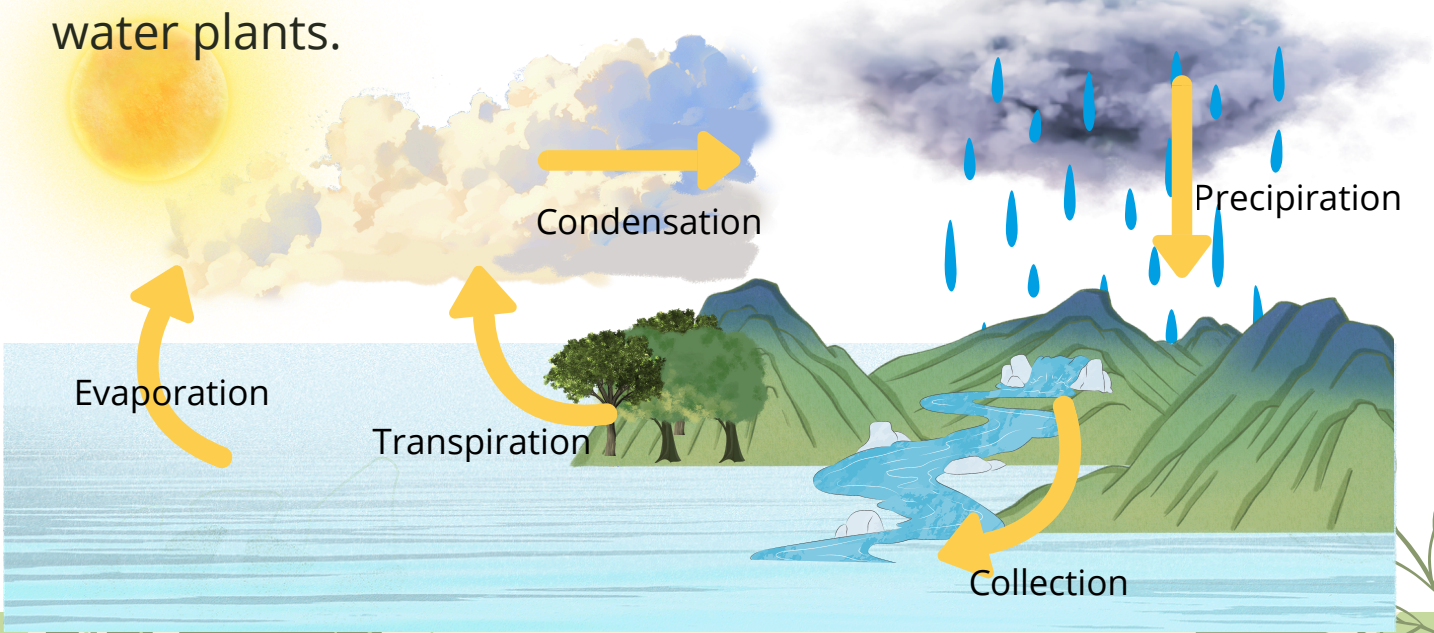
Closing questions,

- What was your most interesting find today?
- What didn't go as planned? How did you solve it?
- What would you do differently next time?
- What are the similarities between the different jars?
- How can we use this knowledge in our own vegetable garden?

8 The water cycle

The water cycle (also called the hydrological cycle) describes how water moves continuously on Earth. It includes four main processes: evaporation, condensation, precipitation, and infiltration. Water from the ocean and land (turns to water vapor/gas) due to heat from the sun, rises into the air, and cools to form clouds (condensation, small liquid drops). When the clouds become heavy, water falls as rain (precipitation). This water then soaks into the ground (infiltration) or flows over the surface (runoff). The flowing water removes nutrients from of the soil (USGS, 2023).

On St. Eustatius, the water cycle plays an important role in gardening. Rainwater is often the main source of water for plants, especially because freshwater is limited on the island. When rain falls, it enters the soil and becomes available for plant roots. Healthy soil helps to store water, so plants can use it over time. In gardening, understanding the water cycle helps students learn when and how much to water plants.



8 The water cycle

However, there are also challenges related to water maintenance and plant health. One major challenge is irregular rainfall. Periods of drought can cause plants to wither, especially in sandy or rocky soils where water drains quickly. On the other hand, too much water can lead to waterlogging, where roots do not get enough oxygen and may rot.

Another challenge is water conservation. Because freshwater is scarce on small islands, gardeners must use water carefully. Techniques such as watering in the early morning, using mulch to reduce evaporation, and collecting rainwater can help improve efficiency.

Water quality is also important. Salty or polluted water can damage plants and reduce growth. Healthy plants need clean water to transport nutrients and maintain their structure.

In summary, the water cycle provides essential water for plant growth, but managing water carefully is key to successful gardening on St. Eustatius.

8 The water cycle

Group 1-2

Learning goal: Students recognize that water moves in a cycle and is needed for plants.

<u>The story of Wally the waterdrop</u>

In attachment 8 is a story of the journey of Wally the waterdrop. The teacher tells the story, and the children listen and act out what is being told. So when the water goes up to the sun (evaporates), the children can all jump. When they form a cloud, they can all come together, and with rain they can all fall down, move through the earth (over the ground) to a plant to water that plant, and then back into the lake (their seats). Let them play and have fun. If they ask questions about the water or the cycle, ask them: "What do you think?" That way they can learn to think for themselves, and it is the start of an important research skill.

Closing, questions to ask:

- Where did your waterdrop go?
- Why do plants need water?

Group 3-4

Learning goal: The student describe the basic steps of the water cycle.

Video: https://www.youtube.com/watch?v=ncORPosDrjI

<u>Water cycle in a bag</u>

Get every pupil a ziplock bag. Let them draw a water cycle symbol on the bag and then put water in it. Hang it by the window. Over the next few days, let them see what is happening with the water. The most important thing for them at this stage is to observe. Let them see for

8 The water cycle

themselves the effects of evaporation and condensation. You, as a teacher, could ask them what they saw in the bag and how that relates to what they drew on it.

Question Closing:

- What did you observe?
- What surprised you?

Group 5-6

Learning goal: Students can explain the different steps of the water cycle to their peers.

<u>Mindmapping and drawing</u>

The students start by making a mind map about water and the water cycle. They write all that they know and associate with it. As a teacher, you ask questions that get them to think:

- How did you get to this answer?
- What else can you associate with the words you wrote down?
- What happens with water after it rains?
- How are clouds formed?
- What do you think? (When they ask you a question they could answer themselves)
- How can you obtain that knowledge yourself?

As a teacher, you go into conversation with the students about the water cycle. When they have collectively figured out how the water cycle works (with some helping hints from you as the teacher), they will make a drawing with names and arrows showing how the water moves. They get to choose the body of water they use. Closing they explain through the drawing how the water cycle works in duos.

8 The water cycle

Closing, questions to ask:

- How easy was it to explain the water cycle to your peers?
- What would you do differently next time?
- What have you learned about the water cycle that is important for the school garden?




Group 7-8

Learning goal: Students can design and evaluate sustainable water management strategies.

Doom scenario's

Water is limited on Statia. We use it for drinking, showering, flushing the toilet, watering the garden, in the kitchen, and in the vegetable garden, at school and more. What are different strategies to save water in the garden (and in and around the house) so it is used more effectively?

The students will design, in trios preferrably, different strategies to save water in the garden. Examples are:

- Collecting rainwater
- Using mulch
- A smart irrigation system

They will present the design plan and how it will save water.





Closing, question to ask:

- Is your solution sustainable? Why yes or no? Explain
- If not, how could you change it to make it sustainable?
- What would you implement in your own garden or in the school garden?
- How did the teamwork go? What would you do differently next time?



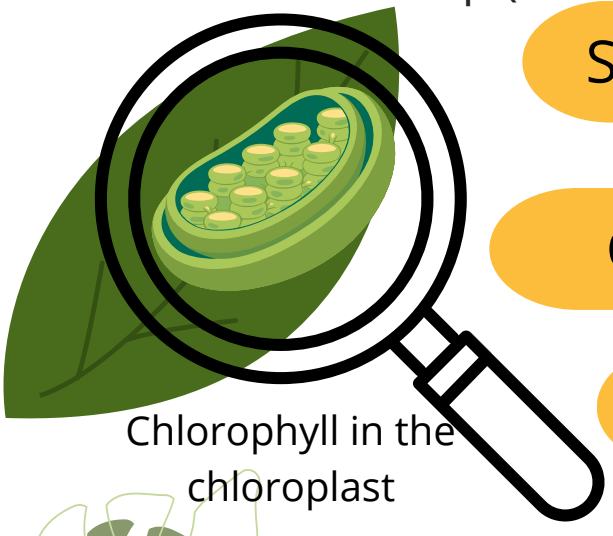
9 The sun and photosynthesis

Photosynthesis is the process by which green plants use light energy from the sun to make their own food. This process takes place mainly in the leaves, inside small structures called chloroplasts, which contain the green pigment chlorophyll. During photosynthesis, plants use carbon dioxide (CO_2) from the air and water (H_2O) from the soil to produce glucose (sugar) and release oxygen (O_2) as a by-product. This process is essential for plant growth and for life on Earth, as it provides oxygen and forms the base of most food chains.

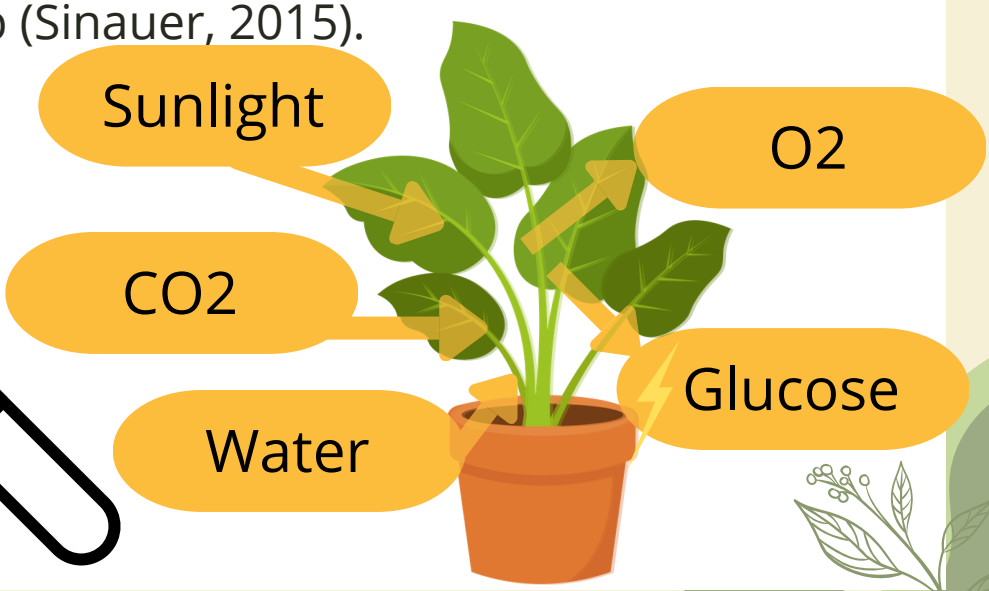
Photosynthesis can be explained in two main steps:

1. Light-dependent reactions

These reactions take place in the chloroplasts in the cells of the leaf when sunlight is available. Chlorophyll absorbs light energy, which is used to split water molecules into oxygen, hydrogen, and electrons. The oxygen is released into the air, while the energy released from splitting the molecules is stored in chemical molecules (ATP and NADPH) that are used in the next step (Sinauer, 2015).



Chlorophyll in the chloroplast



9 The sun and photosynthesis

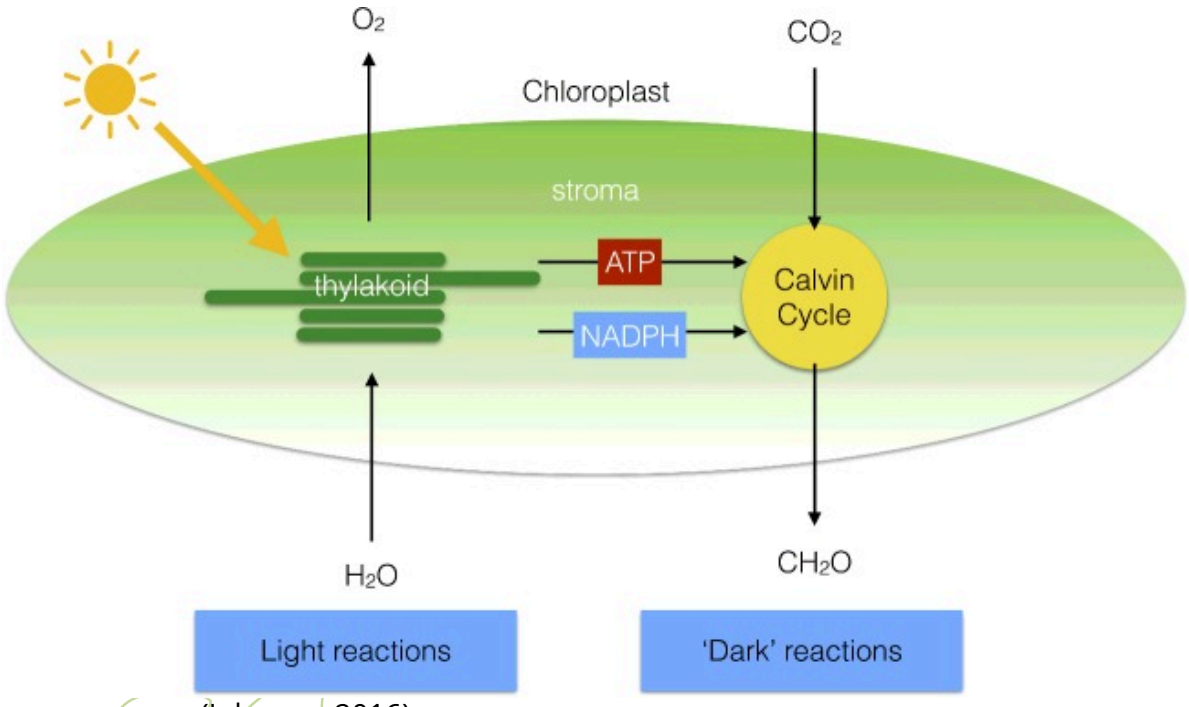
2. Light-independent reactions (Calvin cycle)

These reactions do not require light directly and take place in the chloroplast as well. The plant uses the stored energy (ATP and NADPH) to convert carbon dioxide from the air into glucose, a type of sugar. This glucose is used by the plant for growth, energy, and storage (Chaffey, 2014).

The overall process can be summarized as:

'carbon dioxide + water + light energy → glucose + oxygen'

For teachers, it is important to emphasize that photosynthesis links directly to earlier lessons on plant parts (leaves), water, air, and sunlight. On St. Eustatius, the strong sunlight and warm climate make photosynthesis highly efficient, but water availability can be a limiting factor.



(Johnson, 2016)

9 The sun and photosyntesis

Group 1-2

Learning goal: Pupils recognize that the sun provides warmth and plants need that the sun to grow

<u>Warm stones and cool plants</u>



Go outside on a sunny day. The goal for the pupils is to find warm and cool spots around the playground. They can find stones, sand, tree trunks, leaves, the walls of the school in the sun, and the shadow. Questions you could ask as a teacher:



- Why do you think the stones are warm?
- How can the grass or the leaves be colder than the stones?
- Where does that warmth go?
- Why do you think plants take that warmth of the sun



Afterwords, questions to ask:

- What did you need to grow?
- What happens if there is no sun?



Group 3-4

Learning goal: pupils understand that sunlight affects how plants grow.

<u>Sun or no sun?</u>



There will be three pots with sprouts. One will be placed in the sun, one in partly shade, and one without sunlight. Let the pupils decide where they want to place the plants (responsibility and critical thinking of where to place them). Ask the pupils to predict what will happen with the plants. They could draw their predictions (start of critical thinking and research skills) (attachment 9).





9 The sun and photosyntesis

Let them observe the shadow and sunlight; they could draw the position of the leaves and how they change during the day.
After a week, come back to the plants. There should be a difference now (if not, wait a few more days). Let the pupils draw the plants again, but now they will aim to capture what they see/observe.





Closing questions:

- Is there a difference between the first and last drawing?
- Why do plants need sunlight?
- What can you do to help the plants in the vegetable garden?



Group 5-6

Learning goal: Students can describe what a plant needs to photosynthesize and what it will gain from photosynthesis.

<u>Place the elements</u>

In attachment 10 is a picture of a photosynthesis cycle. All the individual parts are cut out, and the job of the students is to put all the parts where they belong. They use teamwork, critical thinking, and curiosity to get to the answer. As a teacher, you do not help the students. There are hints in the form of questions in the attachment the students can use to get to the right answers.
Review the assignment once they are finished.





Closing questions:

- How did the teamwork go? What went well and what did not?
- Were there difficult parts? How did you resolve the difficulties?
- What could you do when you do not know the answer next time?

9 The sun and photosyntesis

Group 7-8

Learning goal: Students explain the process of photosynthesis and apply it to organize a sustainable garden

<u>Vegetable garden design</u>

First, the students will figure out the process of phtotosynthesis. Then they will incorporate what they learned into a plan for a vegetable garden. Different plants need different amounts of sunlight to get all the food they need. Every group will choose 7 fruits/vegetables. In their garden design, they will explain how much water and sunlight those plants need and how they incorporated that into the design. In the design is the process of photosynthesis explained.





Things to take into consideration for the design:

- Cycle of the sun
- Direction and strength of the wind
- Amount of rainfall on Statia (your location)
- Height of the plants
- How much sun a plant needs
- If plants are good together (help each other or not)

Once they are done, the designs are presented.

Closing:

- How does your design help plants grow better?
- What would you do if plants grew too big and gave more shade than expected?
- What makes your design better than what we have in the garden (if applicablekl
-)?
- What can we do to make the school garden better for all the plants with the knowledge we learned today?




10 Local and import foods

On St. Eustatius, food is supplied from both local production and importation. Understanding the balance between both sources is important for teaching sustainability.
Local foods include crops such as papaya, mango, sweet potato, and herbs, as well as locally caught fish and livestock farming. These foods are often fresher, require far less transportation, and are better adapted to the island's climate and soils. Growing local food can strengthen food security, reduce dependency on external supply chains, and support local knowledge and traditions.
However, St. Eustatius relies heavily on imported food. Due to limited land, water scarcity, and a small agricultural sector, many products—such as rice, dairy, and processed foods—are brought in from abroad. Imports are essential to ensure a stable and diverse food supply, especially during droughts or after extreme weather events (FAO, 2017).



(Jonkers, 2026)

10 Local and import foods

From a sustainability perspective, there are important differences between local and imported foods. Imported foods often have a larger environmental footprint because of transportation, packaging, and storage, which contribute to greenhouse gas emissions (Poore & Nemecek, 2018). In contrast, local foods generally have lower transport emissions, but their sustainability also depends on how they are grown. For example, inefficient water use or soil degradation can still make local production less sustainable.



For education, it is important to help students understand that both systems are necessary. A sustainable future for St. Eustatius may involve increasing local food production where possible while making smarter choices about imports, such as reducing food waste and selecting more sustainable products.

By connecting local gardening activities to global food systems, students can develop a deeper understanding of sustainability, resilience, and responsible consumption.

10 Local and import foods

Group 1-2

Learning goal: Pupils recognize that some foods grow on the island and others come from far away.

Local or far away?

Bring a sample of food to the classroom (if not possible, use attachment 11). Choose some local food items and some from other places in the world. There are two baskets in the classroom "From our island" and "From far away." The pupils take turns placing items in a basket. Ask them questions while placing the different items:

- Why did you pick that basket?
- How do you know it comes from far away?
- Have you seen this item on the island?

Closing:

- Which food comes from our island?
- Where do the other foods come from?
- Which ones traveled far?
- How far did different ingredients travel to make the product?
- Have you tried any of the foods from the island?
- Which one do you like the most?

Group 3-4

Learning goal: pupils understand that food can come from local sources or be imported and that this affects how it gets to them.

The journey of food

All the students will get a role in the journey of food. This can be a: farmer, fisherman, truck driver, ship captain, shopkeeper, local, etc. One group will be responsible for the local food. This is a short

10 Local and import foods

journey, so the distance from the farmer to the shop is short. The other group is responsible for the imported food, which is a long journey. They move a larger distance across the classroom.
The pupils will decide the roles and the routes across to play out the food journeys.

Closing questions:

- Which food had a longer journey?
- How did that make you feel about eating different foods?
- What is the difference between the journeys




Group 5-6

Learning goals: Students investigate where food comes from and compare local and imported foods.

<u>Food mapping</u>

Students bring different types of food to school (with labels) or just food labels to class. They get a big map of the world (best A3/A2 or bigger). They get to sort the food they brought into the countries it came from. Ask them questions about what this means:





- Is it local, international, or intercontinental?
- How does it get to Statia?
- What could that mean for the planet?
- Why do we import specific foods (can they be locally grown?)

Let there be a conversation/dialogue about these topics, and let them justify their conclusions

Closing, questions to ask:

- What surprised you about where food comes from?
- What would you choose differently now?
- Is local always better?

10 Local and import foods

Group 7-8

Learning goal: Students evaluate the advantages and disadvantages of local and imported foods and make informed, sustainable choices.

Sustainable Statia

Statia wants to become more sustainable by producing its own food. The question is: "What food should we grow locally, and what should we import?"



The students will do research about different types of food and determine if it is sustainable to grow it ourselves. That means economically, environmentally and socially viable by balancing ecological protection, social equity, and economic prosperity.



They can look into



- Available soil
- Water availability
- Climate
- Transport impact
- Food security

Closing, they will present their findings to the class with a proposition of what could be grown on the island and what should be imported. This will give them an understanding of food systems, and by making decisions about food growth, they will develop action skills.







Closing, questions to ask:

- How did you choose what foods to grow on the island?
- What are the effects of your choices on the island and its people?
- What if there is a drought or extreme rainfall?



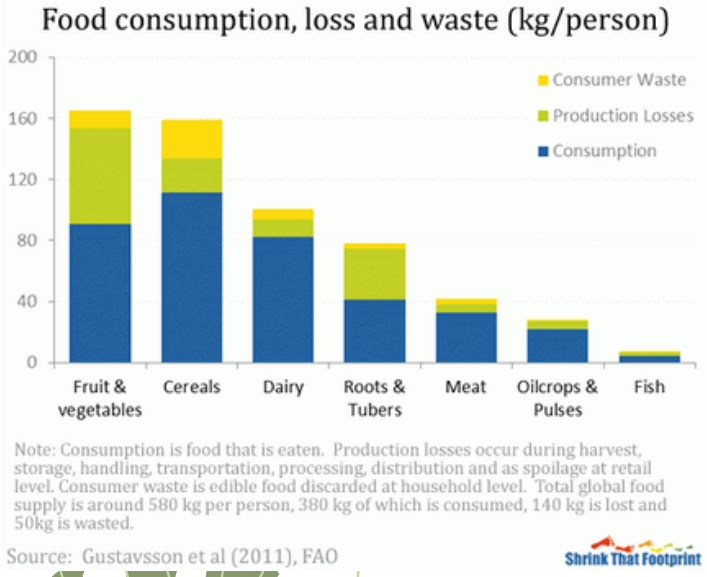


Important: There is no single correct answer, but multiple perspectives that can be explored. Encourage that!

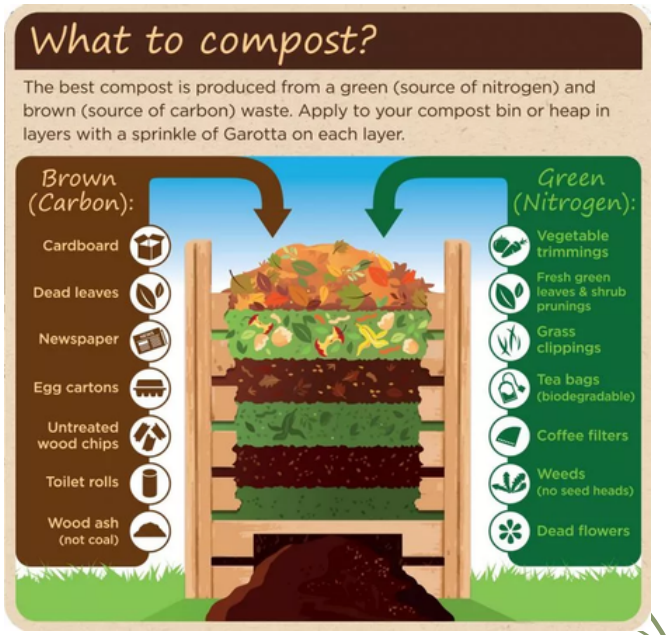
11 Foodwaste, compost, nutriencecycle

Food waste is an important topic for sustainability, especially on small islands like St. Eustatius, where resources are limited. Food waste refers to edible food that is thrown away at home, in schools, or in shops. This not only wastes the food itself but also the water, energy, and labor used to first produce then transport it. Globally, about one-third of all food produced is lost or wasted, which has significant environmental impacts (FAO, 2011).

One way to reduce food waste is through composting. Composting is the natural process of breaking down organic materials, such as fruit peels, vegetable scraps, and garden waste, into a nutrient-rich substance called compost. This process is carried out by microorganisms, fungi, and soil animals like worms. They decompose the material and transform it into humus, which improves soil structure and fertility.



(Wilson, 2023)



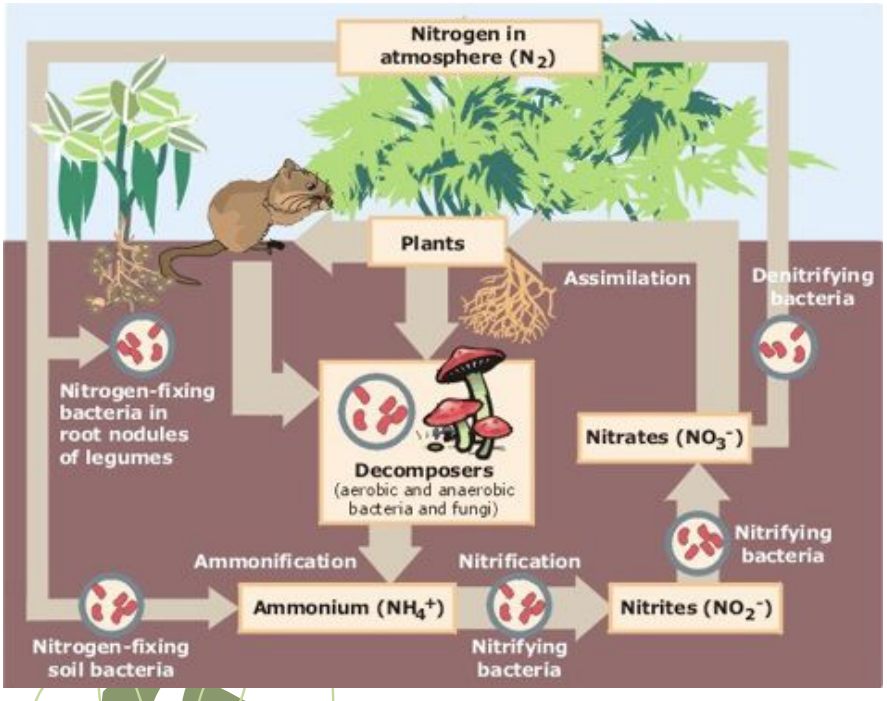
(Garden Health, 2022)

11 Foodwaste, compost, nutriencecycle

Composting is closely linked to the nutrient cycle. In nature, nutrients are constantly recycled. Plants take up nutrients (such as nitrogen, phosphorus, and potassium) from the soil to grow. When plants or food waste decompose, these nutrients are returned to the soil, where they can be used again by new plants. This cycle is essential for maintaining healthy soils and sustainable food production (Brady, Weil & Weil, 2016).

By letting the students engage in composting, they get an understanding that “waste” can actually be a valuable resource for other plants and organisms.

In summary, reducing food waste and using composting supports the natural nutrient cycle, improves soil health, and contributes to a more sustainable food system.



(The compost gardener, z.d.)

11 Foodwaste, compost, nutriencecycle

Group 1-2

Learning goal: Pupils recognize that some food waste can be reused to help plants grow

<u>Trash or Treasure</u>

In the classroom is a mystery box (open on the back, closed in the front. and two holes in the sides). Placed in the mystery box is an item that either belongs in the trash or is a treasure for composting. The pupils feel what it is and guess. They can guess as many times as they want, and they can help each other. After a few guesses (right or wrong), the mystery item gets taken out and can be seen and felt and put in the right place.





Examples of mystery items:

- Fresh banana peels ✓
- Dry mango pit ✓
- plastic bottle ✗
- Leaves ✓
- Whole newspaper ✗
- Leftover dinner with meat ✗
- Takeout boxes ✗
- Piece of wood ✓

Ask ‘why’ questions to stimulate thinking. Let pupils change their answer if they learned something new through the questions and answers that are said.



Closing, questions:

- What did you choose to put in the trash?
- How can we help plants with leftovers?

11 Foodwaste, compost, nutriencecycle

Group 3-4

Learning goal: Pupils understand that food waste can decompose and become useful for plants in the form of humus.
Theory about humus in chapter 7 (Soil and soil-animals)

Video: https://www.youtube.com/watch?v=Q5s4n9r-JGU




Building a composting pile

This activity can either be to make a composting bin for your classroom or to make a composting bin for the pupils to take home. You need a bin with holes in it. The bin can be made of metal, wood, or plastic. In the video the pupils learned that they have to mix brown material with green material like kitchen scraps. You could even add some soil to get the soil animals in the composting pile to get it started.
The important part is that the pupils take the lead in the building of the composting bin. They decide together what goes in and in what layers. They get to assess it together, discuss it and work together. As a teacher, you sit back and observe. When the pupils look at you with a question, ask them: “What do you think?” Let them figure it out together and practice the knowledge from the video.




Closing, questions to aks:

- What will happen to the scraps over time?
- What animals in the soil will help the scraps break down/biodegrade?
- What can you do with your lunch or dinner scraps?
- What is the name of your composting bin? → That way they can ‘feed’ ...[name] after a snack or lunch break.




11 Foodwaste, compost, nutriencecycle

Group 5-6

Learning goal: Students can determine if items are decomposable by conducting research.

<u>Does this decompose?</u>

In the classroom or in the garden is a designated spot where items can be buried. Each student takes an item from home. Examples are:



- Mango peel
- Banana peels
- Plastic bottle
- Glass jar
- Decomposable seeding trays
- Branches/twigs
- Leaves
- Chicken bones

Each of these items is buried and marked with a stick and item name. The goal of this exercise is that students understand that everything has its own decomposing rate and some items never decompose. It directly transfers to littering and cleaning up after oneself.



Every week you unearth the items and see what has happened to them.

Closing, questions:



- What happened with your item?
- What does that tell you about its ability to decompose?
- Can you leave this in nature, or does it belong in the trashcan?
- What would happen if we leave plastic out in nature?

11 Foodwaste, compost, nutriencecycle

Group 7-8

Learning goal: Students research a nutrient cycle and understand how composting plays a role in this cycle.

Video nitrogen cycle: https://www.youtube.com/watch?v=uip4Q6t7yfQ
Video carbon cycle: https://www.youtube.com/watch?v=-wSqQiihf7c
Video phosphorus cycle: https://www.youtube.com/watch?v=Wzo-uFS7LUA



<u>Drawing a biogeochemical cycle</u>







Food has a lot of nutrients that play a key role in our ecosystem. In this lesson, the students are researching the different cycles of three of the most important nutrients: nitrogen, carbon, and phosphorus. Every group of three students will research one of these cycles. They make a visual presentation of the cycle to explain it to their peers. In the presentation they explain the cycle and how it plays a role in composting for the garden

Closing questions,





- What is the most important role your nutrient plays in an ecosystem?
- Where does this nutrient come from before it is in our body? *What do we need to eat?*
- What is something you do not understand fully?
- What method did you use to learn something new today? Was that effective? What would you do differently next time?
- What is something you want to improve about your teamwork skills?

12 What part of the plant do you eat?

Understanding which parts of plants we eat helps you as a teacher connect gardening, nutrition, and sustainability in a meaningful way for your students.
Plants are made up of different organs—roots, stems, leaves, flowers, fruits, and seeds—each with a specific function, and many of these are used as food (Geeks for Geeks, 2025).
We eat roots when plants store nutrients underground. On St. Eustatius, examples include sweet potato and cassava. A special type is the storage root, which stores extra energy for the plant, making it rich in carbohydrates.
Stems transport water and nutrients and can also be eaten. Edible examples include sugarcane or some local herbs.
Leaves are essential for photosynthesis and are commonly eaten because they contain many nutrients. Local examples include callaloo (amaranth leaves), lettuce and spinach-like greens.







12 What part of the plant do you eat?

We also eat flowers, such as broccoli or cauliflower, which are undeveloped flower structures. A flower bud is an early stage of a flower, harvested before it opens.
Fruits develop from flowers after fertilization and contain seeds. On Statia, mango, papaya, and banana are common examples. Fruits play a key role in seed dispersal.
Seeds store energy for new plants and are important food sources, such as beans, corn, and peas.
Understanding these plant parts supports sustainability education. It shows that nearly every part of a plant can be used as food, reducing waste and strengthening local food systems. It links to the school garden, where students can see, smell, and feel the crops. They see the different crops grow, harvest them, and can consume them, which increases awareness of food origins and gives a stronger connection to locally grown foods (CBSE, z.d.; Michaels, et all. z.d.).









12 What part of the plant do you eat?

Group 1-2

Learning goal: Pupils recognize that different foods come from different parts of a plant.

<u>What am I eating?</u>

There are different fruits, vegetables, seeds and other edible plant parts on the table. The pupils pick a plant part. *They eat a piece, describe what it tastes like, feel like, look like and if they like it.* Then they match the food to a big plant on a poster (attachment 12). They specify it by root, leave, fruit, seed, stem or flower.
Then they get to pick a new item *and try that one* and match it.
As a teacher you leave the autonomy to the pupils by stepping back.





Closing, questions:

- What part of the plant did you like the most?
- Did it grow below or above the ground?
- How do you know where it grows?

Group 3-4

Learning goal: Pupils can categorize what part of the plant we eat.

<u>Plant puzzle</u>

Each child represents a part of a plant (root, stem, leaf, flower, seed, or fruit). In the classroom are different edible plant parts present in the form of cards (attachment 13). They can act out the different parts of the plant, and the rest of the pupils help them attain the right cards according to what part of the plant they are.





12 What part of the plant do you eat?

Ask why questions to stimulate critical thinking:

- Why does a plant store food in roots?
- Why does a plant have multiple leaves?
- Why does a plant have leaves that face the sun?
- Why does a plant make fruits?

→ Link these questions to previous lessons to weave all that they learned together.



Closing questions:

- Why do we eat different parts of different plants?
- Which parts of plants have you eaten before?
- What is your favorite thing to eat? Is it a fruit, seed, root, leaf, stem, or something else?

Group 5-6

Learning goal: Students investigate and classify foods based on the plant part they come from.

Test

In the classroom are different food types present from different parts of a plant (best if they are hidden from sight). The students form duos and one of them puts on a blindfold. The one with the blindfold gets to investigate different pieces of food and has to classify them into the plant part they come from. They describe texture, smell and explain why they think it is a root, leaf, fruit, etc. Once they have inspected everything, the roles can be reversed. This could be with some new foods to try out to make it more interesting. Closing: they put all the food items on the table ilike a puzzle to make a full plant with everything in the right place.







12 What part of the plant do you eat?

Closing, questions:

- What new thing did you learn today?
- Is there a food item you have never tasted?
- How can you prove this is a fruit or a root?

Group 7-8

Learning goal: Students analyze how different plant parts contribute to food systems and design a diverse garden.

<u>A diverse and sustainable garden</u>

Students will design a school garden in groups of three. Each garden should have a harvest mixture of:

- Root crops
- Leaf crops
- Fruits
- Seeds
- Other

The students explain why they have included different plants for the different parts. And how these plants support nutrition and sustainability for the garden this year and the years to follow (think of soil, humus and nutrient cycle).

Present their reasoning to their classmates.

Closing, questions to ask:

- What would happen if you only grow one type of crop - monoculture?
- Why is it important to grow different plant parts?
- How does your design reduce waste? (Think of previous lessons)

13 Healthy eating and nutrition



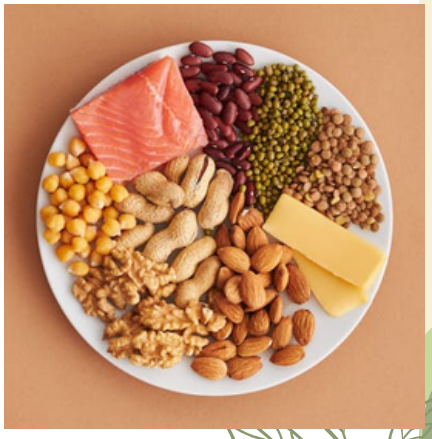
Healthy eating is essential for children's growth, learning, and overall well-being. For teachers, it is important to understand that the human body needs a balance of nutrients to function properly. These nutrients come from food and are divided into six main groups: carbohydrates, proteins, fats, vitamins, minerals, and water (Carpenter, 2026).



Carbohydrates are the body's main source of energy. They are found in foods such as rice, bread, fruits, and root crops like sweet potato, which are common on St. Eustatius. The body breaks carbohydrates down into glucose, which fuels the brain and muscles (Bhupathiraju, 2025).



Proteins are the building blocks of the body. They are needed for growth, repairing tissues, and maintaining muscles, skin, and organs. Protein can be found in foods like fish, beans, eggs, and chicken.



Fats provide energy and help protect organs. They also support the absorption of certain vitamins. Healthy fats can be found in foods like fish, nuts, and plant oils.

13 Healthy eating and nutrition









In addition to these macronutrients, the body needs vitamins and minerals in smaller amounts. These support important processes such as the immune system, bone development, and oxygen transport in the blood (Ferreira, 2024). Fruits and vegetables, such as mango, papaya, and leafy greens, are rich sources.

Finally, water is essential for life. It helps transport nutrients, regulate body temperature, and support all bodily functions .

Alongside healthy foods, it is important to understand unhealthy foods. These are often highly processed foods that contain large amounts of added sugar, salt, and unhealthy fats but few essential nutrients. Examples include sugary drinks, chips, candy, and fast food (WHO, 2026).

In the short term, eating too many unhealthy foods can lead to low energy, difficulty concentrating, mood swings, and hunger shortly after eating. This is because these foods often cause rapid spikes and drops in blood sugar.

13 Healthy eating and nutrition

In the long term, regular consumption can contribute to serious health problems such as overweight and obesity, type-2 diabetes, heart disease, and tooth decay. High salt intake can also increase the risk of high blood pressure, even from a young age (WHO, 2026). Additionally, diets low in nutrients can negatively affect growth, immune function, and overall development in children.
For education on St. Eustatius, it is important to emphasize balance. Both local and imported foods can be part of a healthy diet, but students should learn to make conscious choices: eating more fresh, nutrient-rich foods and limiting highly processed products. This supports not only personal health but also sustainable food systems. Teaching students where nutrients come from and what they do in the body helps them make informed, sustainable food choices and supports lifelong healthy habits.









13 Healthy eating and nutrition

Group 1-2

Learning goal: Pupils recognize that healthy foods help the body grow strong and active.

Feed the body

On the floor is a large drawing of a body. This can be the outline of one of the students. The students draws or places pictures different food items on the body as a way of feeding it. Every time somebody draws something, they make a movement of what that food does to the body. So healthy foods make the body move, dance, and grow. While unhealthy foods make the body tired and slow.





The students can draw different types of food and drinks. Let them come up with the ideas and ask questions to get them to think about why they picked that food and what they think or know it does to the body. What they feel after eating it, for example.





Closing, questions:

- What foods help your body grow?
- What liquids help your body to grow and be active?
- How do you feel after eating healthy foods?

Group 3-4

Learning goal: Pupils understand that different healthy foods help the body in different ways.

Eating the rainbow

Pupils bring foods from home in different colors. In teams they sort through the foods and divide them in different colors. Red and



13 Healthy eating and nutrition

orange for energy and vitamins, green for a strong body and protection, and yellow foods for protein that sustains growth and muscles. The students create a rainbow plate with all of the food (either locally or a mixture of different growth-origins). Let them determine if the food is healthy or unhealthy for their body.
Combine previous lessons with this lesson through questions:

- Where does this come from?
- What part of the plant is this?
- Where have you seen this on the island?

Closing, questions to ask:

- What color food do you eat most?
- What healthy food could you try more often?
- Why is water healthier then soda?
- Why is a fresh mango healthier for your body than a mango candy?

Group 5-6

Learning goal: Students investigate nutrients in foods and explain how they affect the body.

<u>Food packeging</u>

As a teacher you have collected different food packaging over the weeks. This varies from cans, bags, boxes and anything else that is wrapped. Students will examine these packages and investigate the amount of sugar, protein, fats, vitamins in processed by creating a chart. The will compare different brands of the same foods and the difference between canned and other.

13 Healthy eating and nutrition

Content of chart

- Amount of each nutrient
- Effect of nutrients on the body
- Effect of food on the body long and short term
- Something else that interests the students

Closing:



They present their finding to the group



- What surprised you about your food?
- What can you change about your lunch to make it more healthy?



- Discussion opportunity: “Is all packaged food unhealthy?”

Group 7-8

Learning goal: Students evaluate healthy and sustainable food choices and design a balanced meal plan.

<u>Meal menu</u>



The challenge for the students is to design a healthy and sustainable one-day menu for a family on Statia.



Requirements:



- Menu includes all nutrient groups
- Uses local foods where possible
- Limit highly processed foods
- Consider affordability, water use, and imports



Groups present and defend their choices using data they found

Closing:

- Why did your group choose these food items?
- How do these foods affect health and sustainability?
- What would you do if healthy food were more expensive?

14 Reflection

Group 1-2

Learning goal: Pupils can name something they learned about plants or gardening and describe how they helped in the garden.

Memory circle

All the pupils sit in a circle. The teacher places objects from the garden in a circle in the middle of the classroom. Examples are:

- Seeds
- Small garden tools (scoop)
- Leaves
- Compost
- Vegetables
- Watering can

Each pupil chooses one object and tells:



- What it reminds them of
- What they enjoyed



- How they helped care for the garden
- What they want to do next time in the garden

Closing, questions:



- What made you proud in the garden?
- What did you do to help the plants?

Give the pupils time to explain their thinking in their own words. Praise effort, care, and curiosity rather than only success. It is the effort and trying that counts.

Group 3-4

Learning goal: Pupils reflect on their learning process and recognize how teamwork and care helped the garden grow.

14 Reflection

Reflection treasure hunt

In the garden, there are reflection cards hidden. Each card contains a question. The students will search for the cards. Once all the cards are found, they will gather and discuss the questions.
The goal is to encourage students to explain the 'why' of their answer.





Closing questions:

- How did the teamwork help in the garden?
- What is something you still want to learn?

Group 5-6

Learning goal: Students analyze their learning journey and explain how their actions influenced the garden and the group process.

Museum walk

Each student creates a mini station for the museum walk. In these stations can be visual presentations like drawings, photos, collected data, compost, and worksheets.
The students walk around the classroom and leave sticky notes on the stations of other students. This could be:





- Complements
- Questions
- Ideas for improvement

Closing discussion



- What worked well?
- What challenges did you face?
- How did your thinking change during the project?

14 Reflection

Group 7-8

Learning goal: Students critically evaluate the garden project and develop recommendations for more sustainable future gardening systems.

Future garden
Students work in teams to evaluate the work in the garden. They step into the role of a 'Garden Expert'. The evaluate:




- Water use
- Soil care
- Composting
- Teamwork
- Communication
- Harvest success
- Food waste
- Sustainable choices

Each team creates a presentation with:

- What went well in the garden
- An improvement plan
- Recommendations for the next planting session (next year's students)

Closing questions:



- How can we use what we learned in daily life?
- What was something that stuck with you in these lessons?
- What is a personal goal you would like to work on in the next gardening season?

Literature

Literature

Agriculture Institute (2025, 16 juni) *Techniques for safe harvesting of horticultural produce.* Geraadpleegd op 4 mei 2026 van, https://agriculture.institute/food-fundamentals-fv/safe-harvesting-horticultural-produce/

Barbosa-Cánocas, G.V., Fernández-Molina, J.J., Alzamora, S.M., Tapia, M.S., López-Malo, A. & Chanes, J.W. (2003) *Handeling and preservation of fruits and vegetables by combined methods for rural areas. Chapter 2, Basic harvest and post-harvest handeling cosiderations for fresh fruits and vegetables.* Geraadpleegd op 4 mei 2026 van, https://www.fao.org/4/y4358e/y4358e05.htm#bm05

Bewley, D., Bradford, K. J., Hilhorst, H. W. M., & Nonogaki, H. (2013). Seeds : Physiology of development, germination and dormancy, 3rd edition. In *Socio-Environmental Systems Modeling*. https://doi.org/10.1007/978-1-4614-4693-4

Bhupathiraju, S. N. (2025, november) *Carbohydrates, proteins and fats.* Geraadpleegd 4 mei 2026 van, https://www.msdmanuals.com/home/disorders-of-nutrition/overview-of-nutrition/carbohydrates-proteins-and-fats?ruleredirectid=742query=Carbohydrates%2C+Proteins%2C+and+Fats

Boeckmann, C. (2025, 9 oktober) *When to Harvest Vegetables and Fruit for Peak Flavor.* Geraadpleegd op 4 mei 2026 van, https://www.almanac.com/when-harvest-vegetables-and-fruit-best-flavor

Brussaard, L et al. (1997, december) Biodiversity and ecosystem functioning in soil. Geraadpleegd op 30 maart van, https://www.researchgate.net/publication/201996437_Biodiversity_and_ecosystem functioning_in_soil

Carpenter, K. (2026, 1 maart) *Essential nutrients.* Geraadpleegd op 4 mei 2026 van, https://www.britannica.com/science/human-nutrition/Dietary-and-nutrient-recommendations

CBSE (z.d.) *Edible parts of plants that we eat as food*. Geraadpleegd op 4 mei 2026 van, https://www.cbsetuts.com/plant-parts-as-food/

Chaffey, N. (2014). Raven biology of plants, 8th edn. *Annals Of Botany*, *113*(7), vii. https://doi.org/10.1093/aob/mcu090

Faber, F., & Voerman, L. (2024) Didactisch coachen. (14e druk) De Weijer Uitgeverij.

FAO (2017) The future of food and agriculture. Trends and challenges. Geraadpleegd op 30 maart 2026 van, https://openknowledge.fao.org/server/api/core/bitstreams/2e90c833-8e84-46f2-a675-ea2d7afa4e24/content

Literature

FAO (2011) Global food losses and food waste. Geraadpleegd op 30 maart 2026 van, https://www.fao.org/4/mb060e/mb060e.pdf

Ferreira, M. (2024, 14 oktober) *6 essential nutrients and why your body needs them.* Geraadpleegd op 4 mei 2026 van, https://www.healthline.com/health/food-nutrition/six-essential-nutrients

Frijters, S. (2016) Leren voor duurzame ontwikkeling. Gewoon Doen! [2e herziende druk] Uitgeverij: Aeres Hogeschool Wageningen

Garden Health. (2022, 9 november). *How to compost - Garden Advice - Westland Garden Health*. [illustration] What is compost. Geraadpleegd op 18 mei 2026 van, https://www.gardenhealth.com/advice/how-to-guides-2/how-to-compost

GeeksforGeeks. (2025, 23 juli). *Parts of plants and their functions*. Geraadpleegd op 4 mei 2026 van, https://www.geeksforgeeks.org/biology/parts-of-plants/

Geeks for geeks (2025-a, 23 juli) *parts of a flower* [illustratie] Geeks for geeks. Geraadpleegd op 15 april 2026 van, https://www.geeksforgeeks.org/biology/parts-of-plants/

Geeks for geeks (2025-b, 23 juli) *types of root* [illustratie] Geeks for geeks. Geraadpleegd op 15 april 2026 van,https://www.geeksforgeeks.org/biology/tap-root-diagram/

Herrald, D. & Vancura, C. (2016, 11 okt) *reliable roots* [illustratie] DH lifestyle. Geraadpleegd op 15 april 2026 van, https://www.durangoherald.com/articles/reliable-roots/

Home Learning (2020, juni 2025) *disperse of seeds* [illustratie] Holbrook. Geraadpleegd op 15 april 2026 van, https://year3holbrookps.wordpress.com/2020/06/25/25-6-20-science/

IERE team (2025, 15 juni) What are four environmental conditions for plant growth? Geraadpleegd op 24 maart 2025 van, https://iere.org/what-are-the-four-environmental-conditions-for-plant-growth/

Indiana native plant society (z.d.) *Process of seed germination* [illustration] Indiana native plant society. Geraadpleegd op 15 april 2026 van, https://indiananativeplants.org/seed-biology-dispersal/

Johnson, M. P. (2016). Photosynthesis. *Essays in Biochemistry*, *60*(3), 255–273 [illustration]. Geraadpleegd op 13 mei 2026 van, https://doi.org/10.1042/ebc20160016

Jonkers, S (2026) Shipment 1 april 2026 [photo] Own photo

Keeley, P. (z.d.) *Needs of Seeds*. NSTA. Geraadpleegd op 24 maart 2026 van, https://www.nsta.org/lesson-plan/needs-seeds-0?com

Literature

Michaels, T., Clark, M., Hoover, E., Irish, L., Smith, A. & Tepe, E. (z.d.) *plant parts we eat*. Geraadpleegd op 4 mei 2026 van, https://bio.libretexts.org/Bookshelves/Botany/The_Science_of_Plants_-_Understanding_Plants_and_How_They_Grow_(Michaels_et_al.)/01%3A_Plants_in_our_Lives/1.03%3A_Plant_Parts_we_Eat

Milkwood. (2021, 23 september). *The Milkwood Soil Type Calculator*. Milkwood: Permaculture Courses, Skills + Stories. [illustration] Geraadpleegd op 21 mei 2026 van, https://www.milkwood.net/soil-type-calculator/

Mischa. (2021, 13 april). *Just add water? Weird ways plants germinate*. Curious. Geraadpleegd op 24 maart 2026 van, https://curious.science.org.au/earth-environment/plant-germination?com

My-permaculture (2018) *step three, photo 4* [foto]. Steemit. Geraadpleegd op 15 april 2026 van, https://steemit.com/permaculture/@my-permaculture/germinate-your-own-mago-seeds-3-extremely-rewarding-minutes

OECD (2018) Organisation for Economic Co-operation and Development. *The future of education and skills: Education 2030.* Geraadpleegd op 22 mei 2026 van, https://www.oecd.org/en/about/projects/future-of-education-and-skills-2030.html

Pearson, B.J. (z.d.) Soil Characteristics and Management Practices for Urban Residential Landscapes. Geraadpleegd op 4 mei 2026 van, https://ask.ifas.ufl.edu/publication/EP479

Pexels (z.d.) Nematode [photo] Geraadpleegd op 25 mei 2026 van, https://www.pexels.com/nl-nl/foto/natuur-druppels-bubbels-biologie-8740297/

Poore, J., & Nemecek, T. (2018) Reducing food's environmental impacts. Geraadpleegd op 30 maart 2026 van, https://josephpoore.com/Science%20360%206392%20987%20-%20Accepted%20Manuscript.pdf

Schouten Biologie (z.d.) Bevruchting [illustratie] Geraadpleegd op 16 mei 2026 van https://schouten-biology.weebly.com/sect63-bevruchting.html

Sharma, N. (2025, 4 juni) *plant seed* [illustratie] Microbe notes. Geraadpleegd op 15 april 2026 van, https://microbenotes.com/plant-seed/

Sinauer, A.D. (2015) Plant Physiology and Development, 6th edition. Geraadpleegd op 30 maart 2026 van, https://sirsyedcollege.ac.in/crm/public/uploads/download_image/H8aTDrHeKuTogISO7SE1r80gjP2dmU.pdf

Literature

Sonneveld, A. (2025) *Towards a coherent program for green-blue education on Saba and St. Eustatius*. Geraadpleegd op 18 mei 2026 van, Towards a coherent program for green-blue education on Saba and St. Eustatius final version 1.1.pdf

The compost gardener (z.d.) The nitrogen cycle [illustration] The nitrogen cycle – Bacteria's role. Geraadpleegd op 18 mei 2026 van, https://www.the-compost-gardener.com/nitrogen-cycle.html

Turner, S. (2018, 27 oktober) *Clusia rosea 'Nana' (Dwarf Pitch Apple)* [foto] Richard lyons nursery. Geraapdleegd op 21 april 2026 van, https://www.richardlyonsnursery.com/clusia-rosea-nanadwarf-pitch-apple/#page-content

UNESCO (2017) Education for Sustainable Development Goals: Leaning objectives. Geraadpleegd op 22 mei 2026 van, https://unesdoc.unesco.org/ark:/48223/pf0000247444

USDA (2023) The water cycle. Geraadpleegd op 30 maart 2026 van, https://www.usgs.gov/water-science-school/water-cycle

USDA (z.d.) Natural Recources Conservation Servivce. What is soil health? Geraadpleegd op 30 maart 2026 van, https://www.nrcs.usda.gov/conservation-basics/natural-resource-concerns/soil/soil-health

Weil, N.C., Brady, R.R. and Weil, R.R. (2016) The Nature and Properties of Soils. Fifteenth Edition, Pearson, Columbus. Geraadpleegd op 30 maart 2026 van, https://www.researchgate.net/publication/301200878_The_Nature_and_Properties of_Soils_15th_edition

WHO (2026, 26 januari) *Healthy diet*. Geraadpleegd op 4 mei 2026 van, https://www.healthline.com/health/food-nutrition/six-essential-nutrients

Will, M.J. (2021, 25 oktober) *store seeds* [foto] Empress of dirt. Geraadpleegd op 15 april 2025 van, https://empressofdirt.net/how-to-save-heirloom-tomato-seeds/

Wilson, L. (2023, 26 augustus). *The Food Wastage Footprint is Big – How Much Food is Wasted Every Year*. Shrink That Footprint. [diagram] Geraadpleegd op 18 mei 2026 van, https://shrinkthatfootprint.com/the-big-footprint-of-food-waste/

Attachments

Flowers

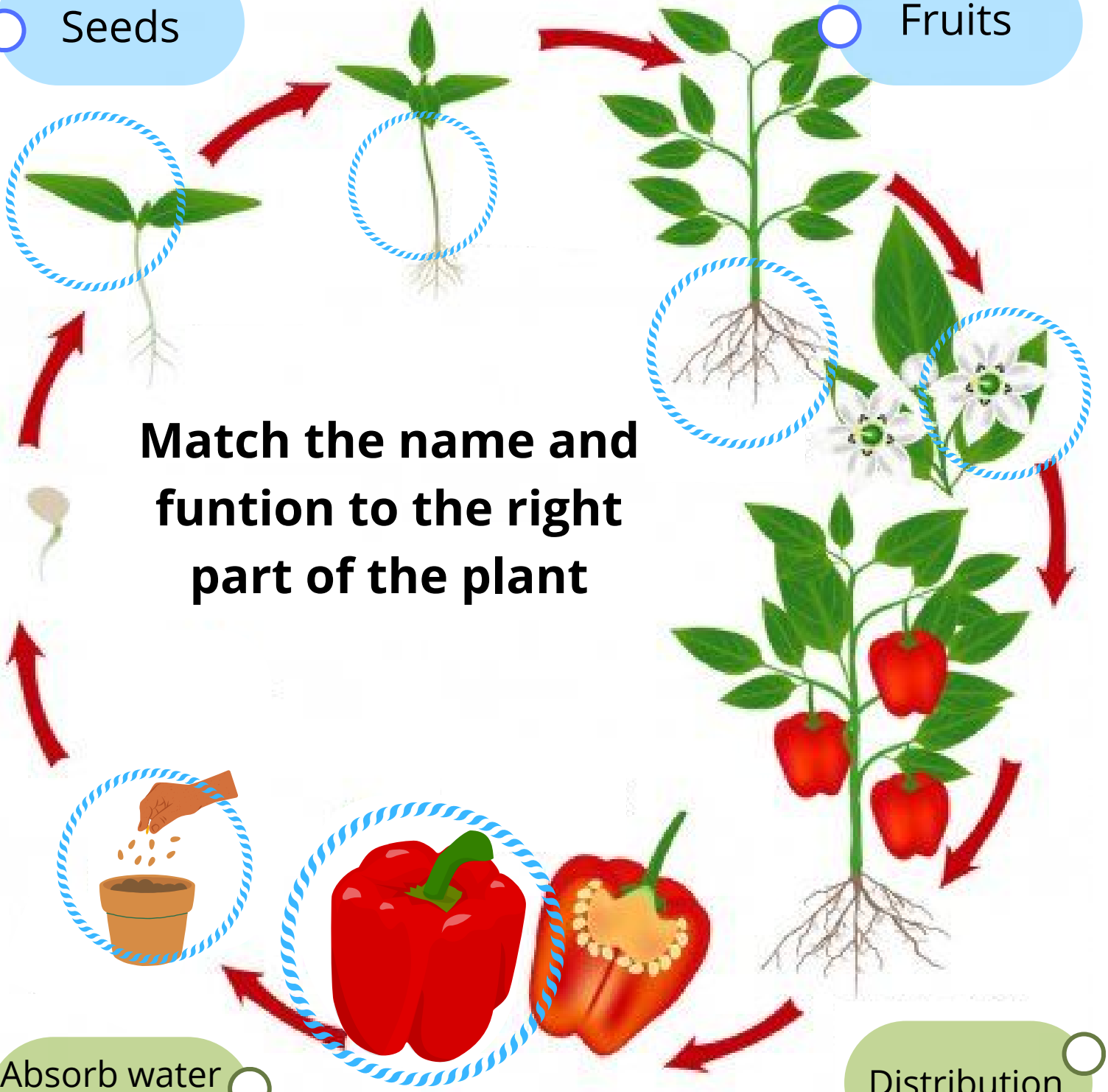
Stem

Roots

Leaves

Seeds

Fruits



Match the name and funtion to the right part of the plant

Absorb water and nutrients

Distribution

Reproduction

Breathing: absorbtion and release of gasses

Sturdiness and transport system

Seed distribution

The function of plant parts

Name of the plant: _____

Plant part:

What do you see: _____
What do you feel: _____
What do you smel: _____
Function of this part: _____
Why this function: _____

Plant part:

What do you see: _____
What do you feel: _____
What do you smel: _____
Function of this part: _____
Why this function: _____

Plant part:

What do you see: _____
What do you feel: _____
What do you smel: _____
Function of this part: _____
Why this function: _____

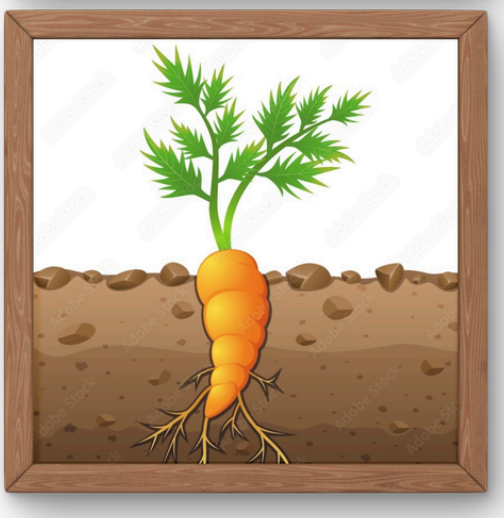
Plant part:

What do you see: _____
What do you feel: _____
What do you smel: _____
Function of this part: _____
Why this function: _____

Plant part:

What do you see: _____
What do you feel: _____
What do you smel: _____
Function of this part: _____
Why this function: _____











Case 1 – Statia: Dry hillside

- Climate: Hot, tropical
- Rain: Very low
- Wind: Moderate
- Sun: Very high
- Soil nutrients: Low
- Soil type: Rocky

Main challenge: Water scarcity (drought)

Case 2 – Statia: School garden

- Climate: Warm
- Rain: Moderate
- Wind: Low
- Sun: High
- Soil nutrients: Medium
- Soil type: Loose soil

Main challenge: Water quickly dries out in topsoil

Case 3 – Statia: Coastal area

- Climate: Tropical
- Rain: Moderate
- Wind: Strong
- Sun: High
- Soil nutrients: Low
- Soil type: Sandy

Main challenge: Strong wind and unstable soil

Case 4 – Netherlands: Wet grassland

- Climate: Temperate
- Rain: High
- Wind: Moderate
- Sun: Medium
- Soil nutrients: High
- Soil type: Clay

Main challenge: Too much water

Case 5 – Brazil: Rainforest

- Climate: Hot, humid
- Rain: Very high
- Wind: Low
- Sun: Low (forest canopy)
- Soil nutrients: Low
- Soil type: Thin topsoil

Main challenge: Lack of nutrients in deeper soil layers

Case 6 – USA (Midwest): Farmland

- Climate: Seasonal
- Rain: Moderate
- Wind: Moderate
- Sun: High
- Soil nutrients: High
- Soil type: Deep, fertile

Main challenge: Efficient nutrient uptake for fast growth

Case 7 – Morocco: Desert

- Climate: Very hot
- Rain: Very low
- Wind: Strong
- Sun: Extreme
- Soil nutrients: Very low
- Soil type: Sandy

Main challenge: Extreme drought and scarce water

Case 8 – India: Tropical forest floor

- Climate: Warm
- Rain: High
- Wind: Low
- Sun: Low
- Soil nutrients: Medium
- Soil type: Moist

Main challenge: Limited sunlight and space

Taproot D

Why: A taproot grows deep into the ground, allowing the plant to reach hidden water sources far below the surface. This helps the plant survive long dry periods where surface water is unavailable.

Fibrous root H

Why: Fibrous roots spread widely near the surface, allowing the plant to quickly absorb water after rainfall or watering before it evaporates.

Aerial/prop roots C

Why: These roots grow above and into the soil, creating extra support and stability, preventing the plant from being blown over.

Fibrous root G

Why: Shallow roots can access oxygen near the surface and avoid deeper, waterlogged layers where roots might suffocate.

Aerial roots A

Why: These roots grow above or along the surface, helping the plant capture nutrients from decomposing material in the top layer.

Fibrous root F

Why: A dense network of roots increases the surface area, allowing the plant to absorb nutrients quickly and support rapid growth.

Taproot B

Why: Taproots grow deep to access underground water reserves that are not available near the surface and stabilize the plant.

Rhizome root E

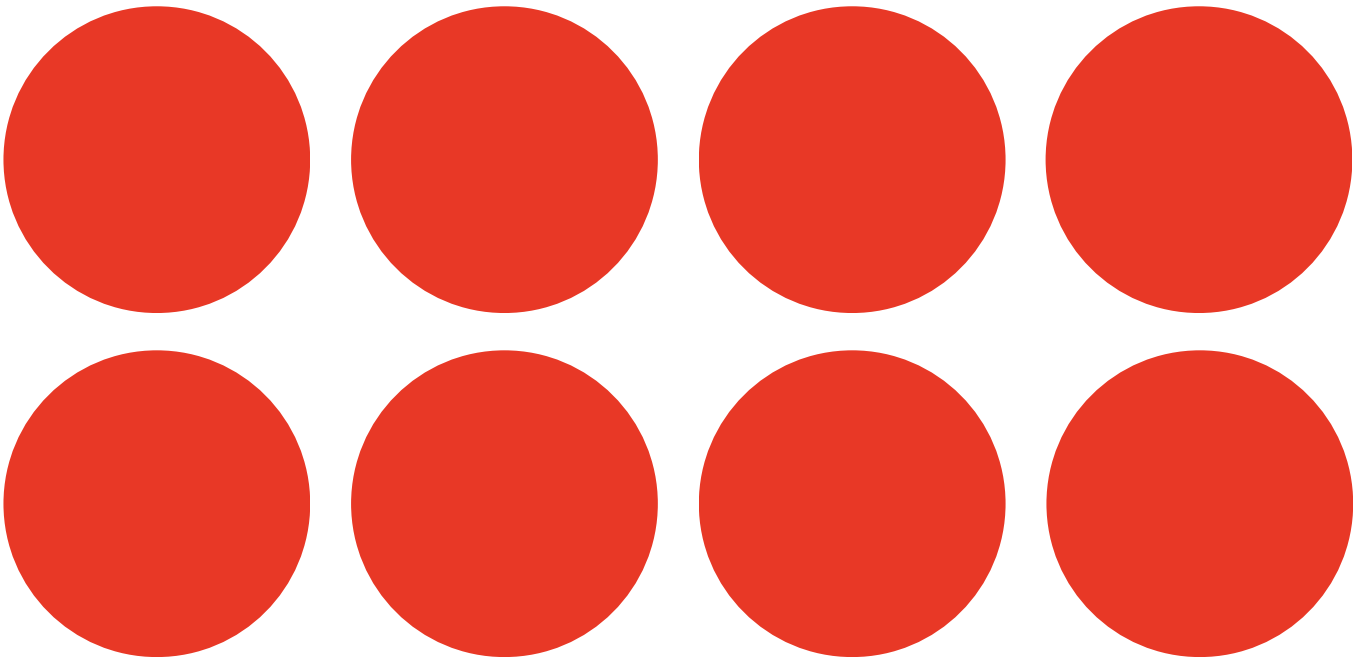
Why: Rhizomes grow horizontally underground, allowing plants to spread and find better light conditions without needing vertical growth.

Answers:
Case 1 = D
Case 2 = H
Case 3 = C
Case 4 = G
Case 5 = A
Case 6 = F
Case 7= B
Case 8 = E



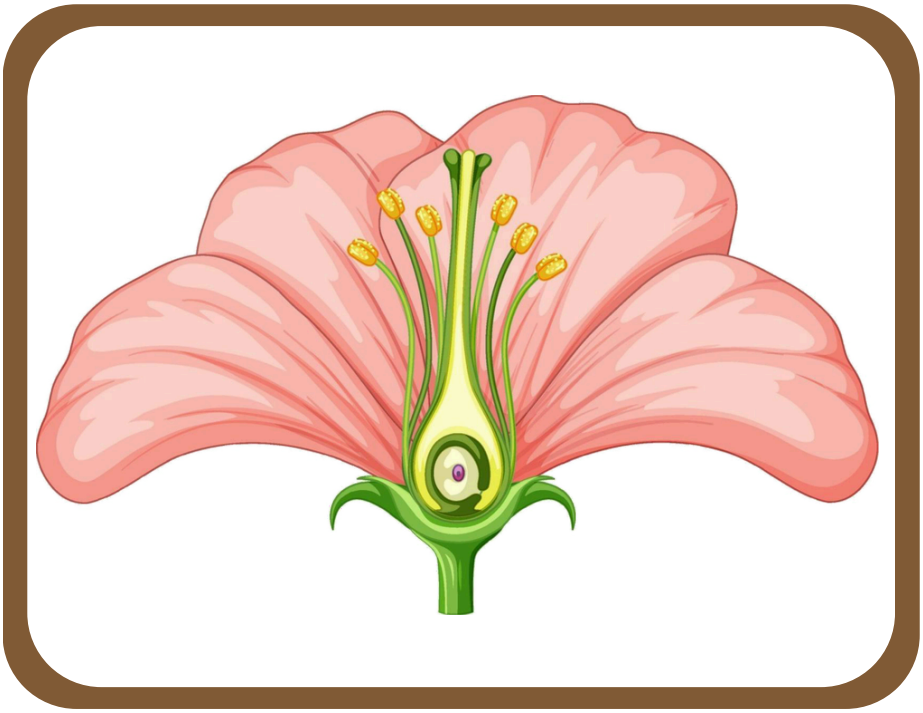




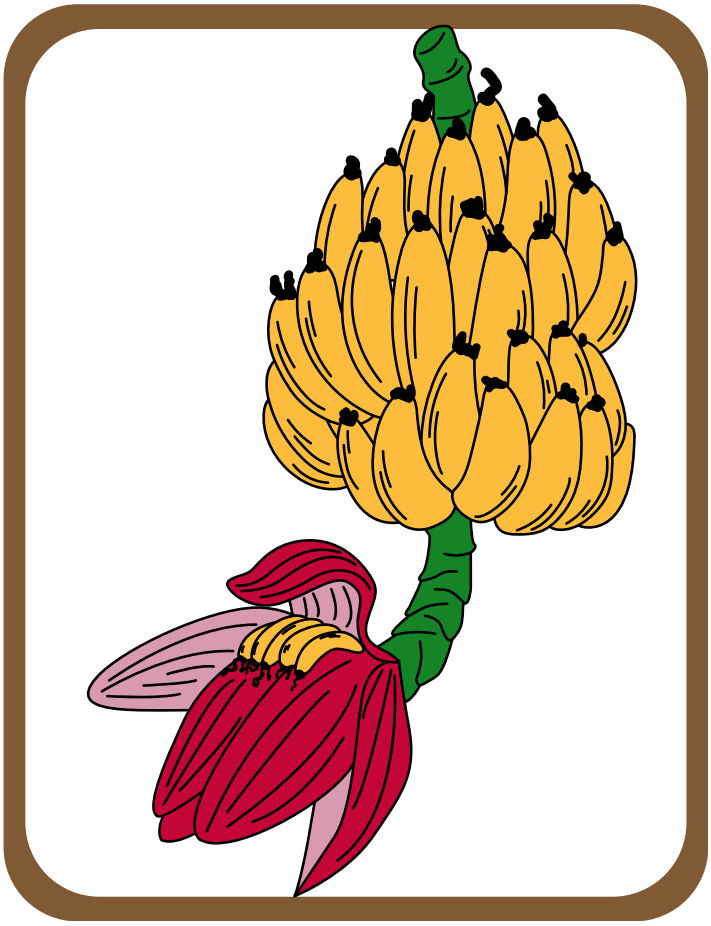


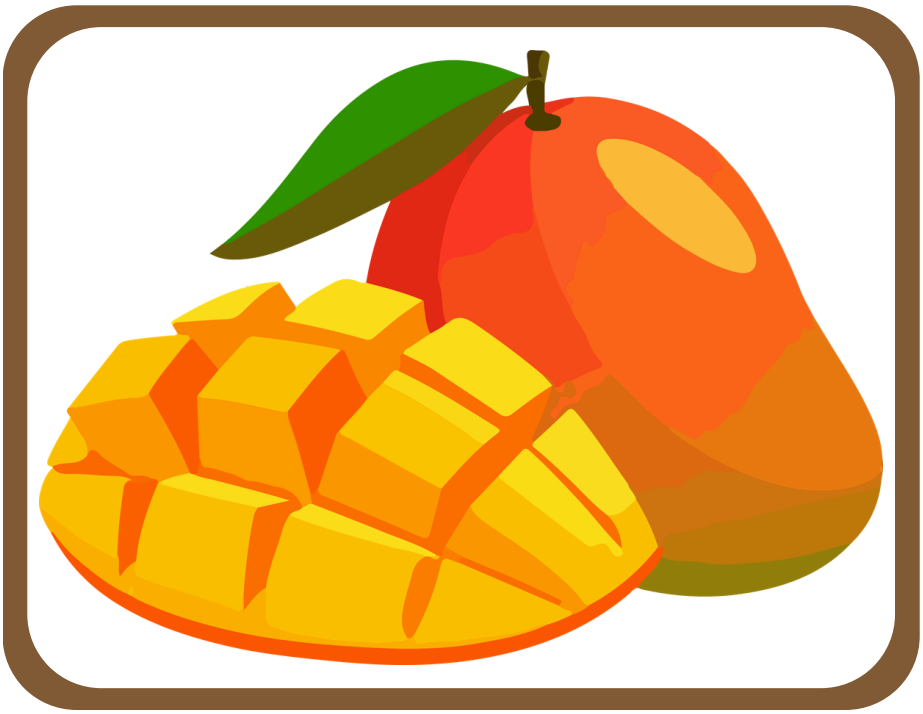




























(Turner, 2018)





“The Journey of Wally the Water Drop”

Hello… my name is Wally. I am a tiny water drop. I live in a big, blue lake on a warm island. I love floating with my friends, splashing gently in the water.

One sunny morning, something special happens.

High up in the sky, the bright, warm sun smiles down at me.

“Oh hello, Wally!” says the sun. “Come on up, I have an adventure for you!”

I feel warmer… and warmer… and warmer…

“Oh! I feel so light!” I say.

Slowly, I start to float up into the air. Up, up, up I go!

“I’m flying!” I giggle.

This is called evaporation, but I just call it my flying moment.

As I float higher, I meet many other tiny water drops.

“Hi! Hi! Hi!” we all say.

We hold hands and cuddle close together.

Soon, we become a big, fluffy cloud.

“Look at us!” says my friend Lila. “We’re a cloud now!”

We drift across the sky, soft and white like cotton candy.

But then… more and more water drops join us.

And more...
And more...
“Oh dear,” I say, “we’re getting very full!”
The cloud starts to feel heavy.
Too heavy.
“I think we’re too big!” someone shouts.
“Oh no... I think it’s time...” I whisper.
And then—
PLOP!
Down I fall!
Wheeeeeee!
I fall from the cloud as rain, zooming down through the air.
“This is fun!” I laugh.
Down, down, down I go until—
SPLASH!
I land on the ground.
Some of my friends land on leaves.
Some on rooftops.
And me? I land softly on the soil.
“Hello, earth!” I say.
The ground drinks me in.
Slowly, I slip down... deeper and deeper...
This is called soaking into the soil, but it feels like a secret underground slide.
Down below, I meet roots of plants.

“Hello!” says a small plant. “I need water to grow strong.”
“Oh! That’s me!” I say proudly.
The plant drinks a little bit of me.
“Thank you, Wally,” it says. “Now I can grow big and green!”
I feel happy. I helped a plant!
The rest of me keeps moving through the soil, slowly traveling underground.
Until… I see light again.
I trickle out into a small stream.
“Wheee!” I say as I move along.
The stream joins a river.
The river flows back into the big, blue lake.
And there I am again… home.
Back where I started.
Floating peacefully.
But I know something now.
“This isn’t the end,” I smile.
I look up at the sun again.
“Ready for another adventure?” the sun asks.
“Yes!” I laugh. “Let’s go again!”
And up I go…
Floating, forming clouds, falling as rain, helping plants, and returning home.
Again and again.

Because I am Wally the water drop...
...and I am always on a journey.
The end.

Name:_____

Prediction sun

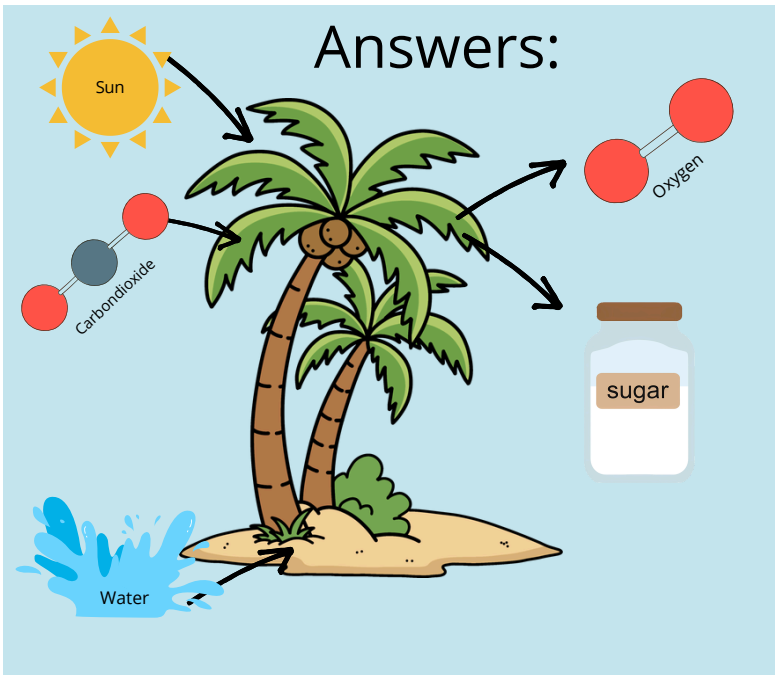
Observations sun

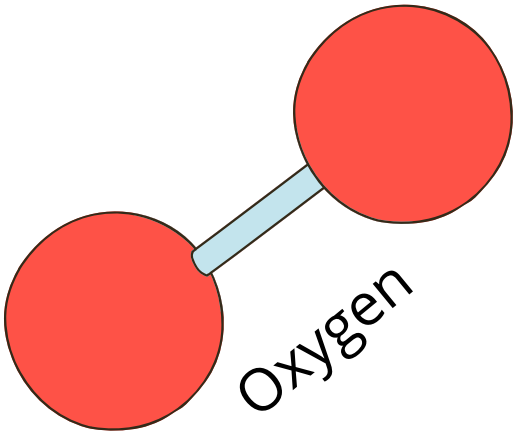
Prediction half sun

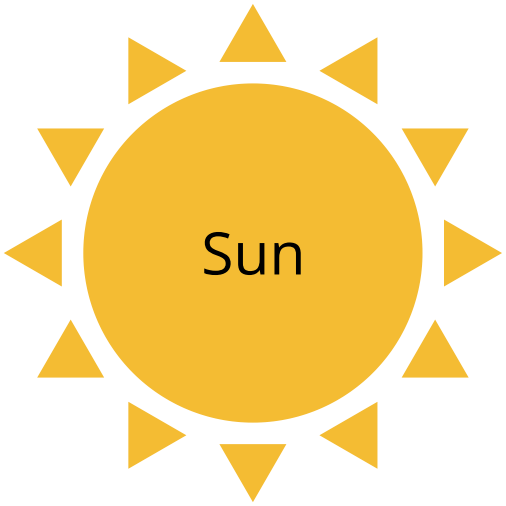
Observations half sun

Prediction no sun

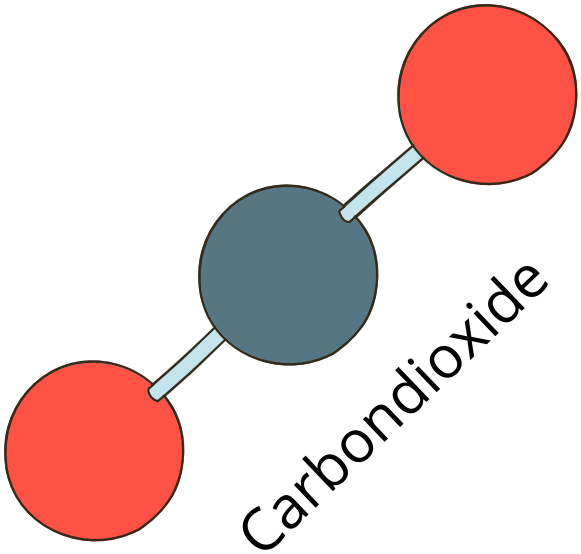
Observations no sun


Answers:
Sun
Carbondioxide
Oxygen
sugar
Water

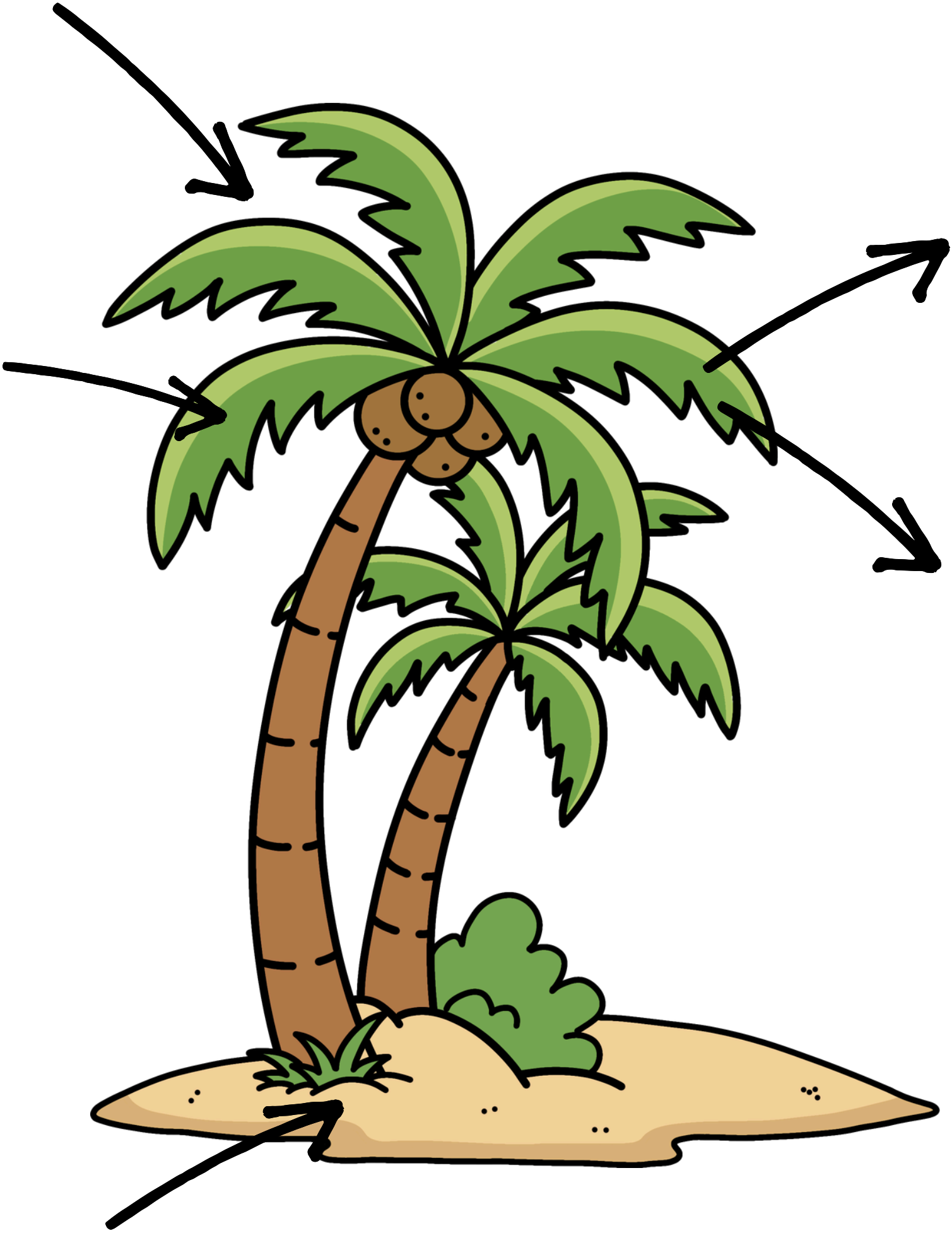

Oxygen


Sun


Water


Carbondioxide


sugar



Guiding hint questions

Give them (or one of them) when they struggle and are stuck. Do not give them from the start and not all at once

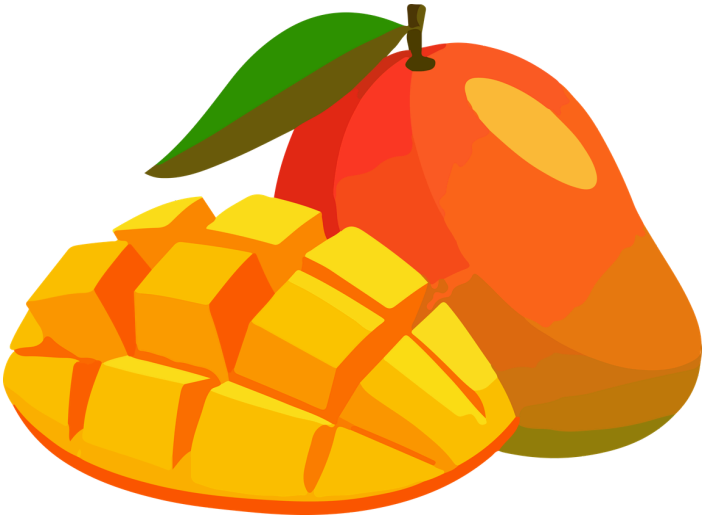
What gives the plant energy to make its own food?

What gas do we breath out and plants take in through their leaves?

What do roots take in from the soil to help the plant grow?

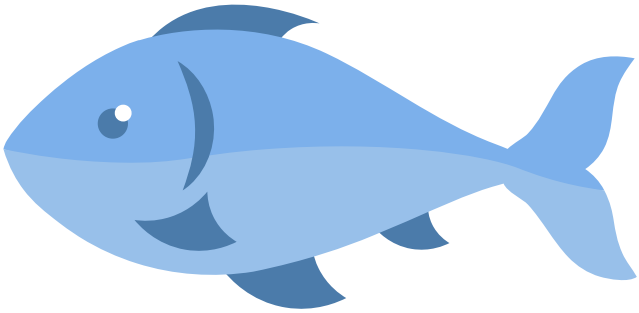
What does the plant make as food to grow strong and healthy?

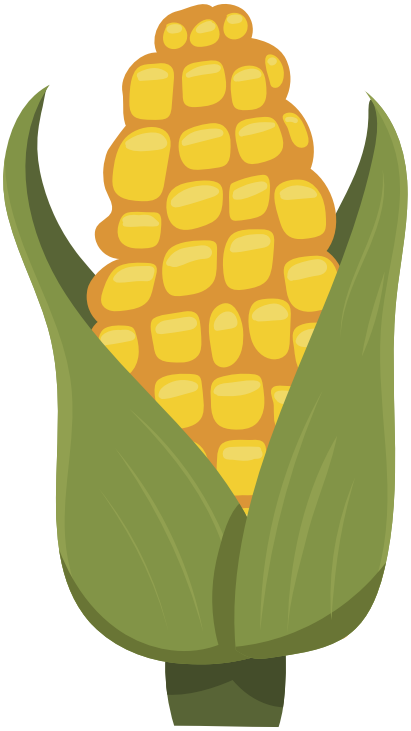
What gas do plants release back into the air after making food?

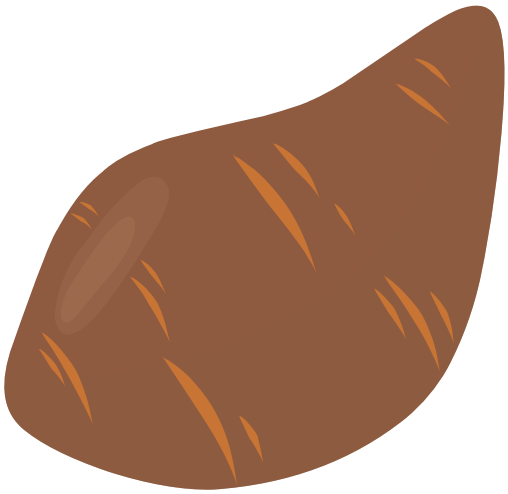




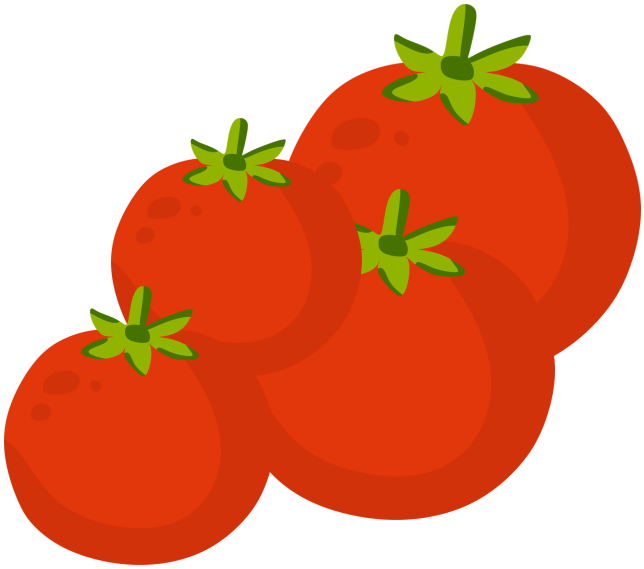

MILK

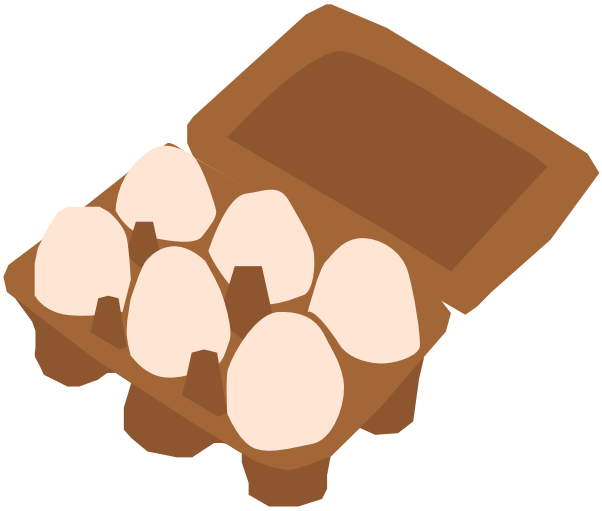


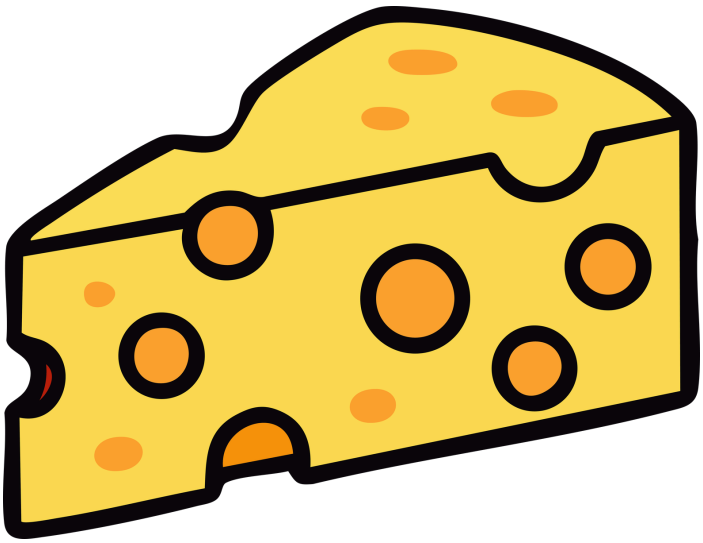


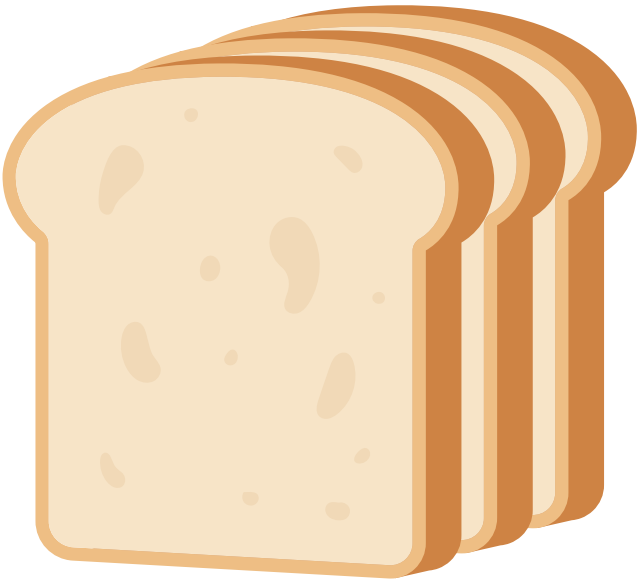



RICE
2KG

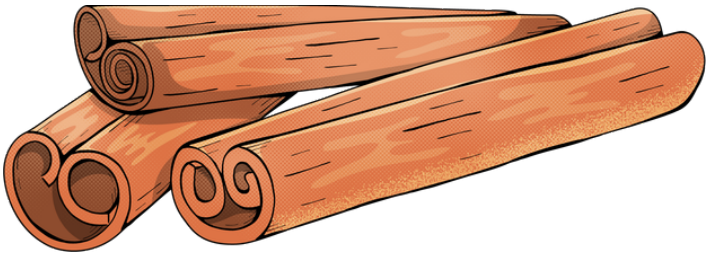


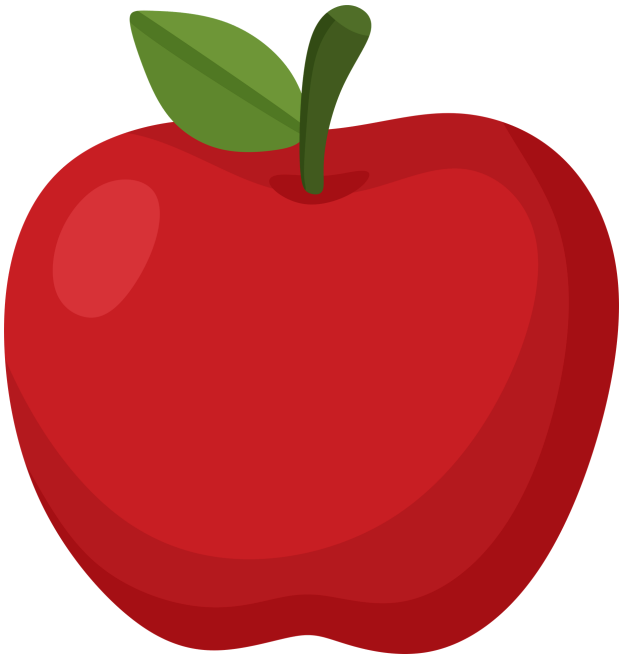










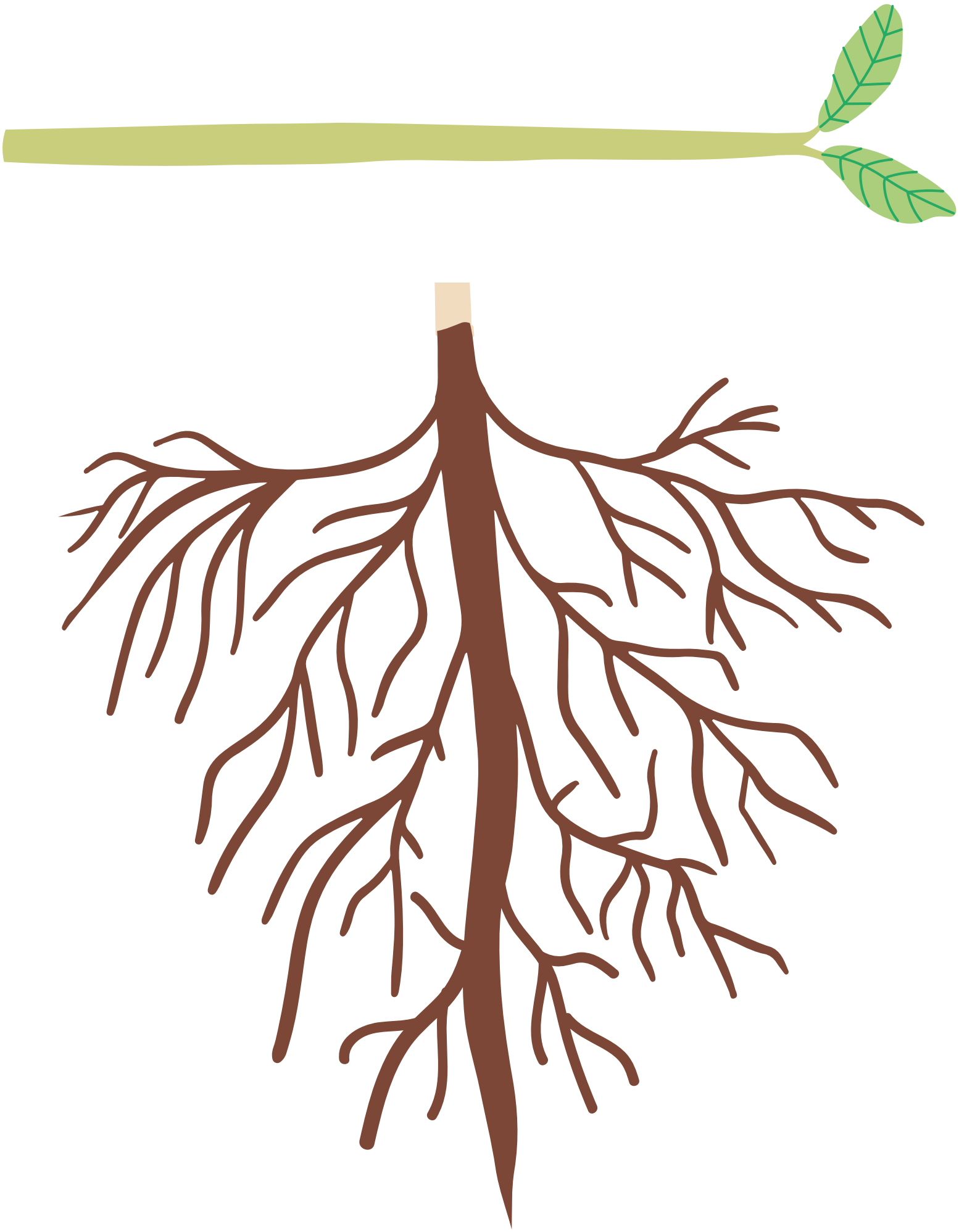


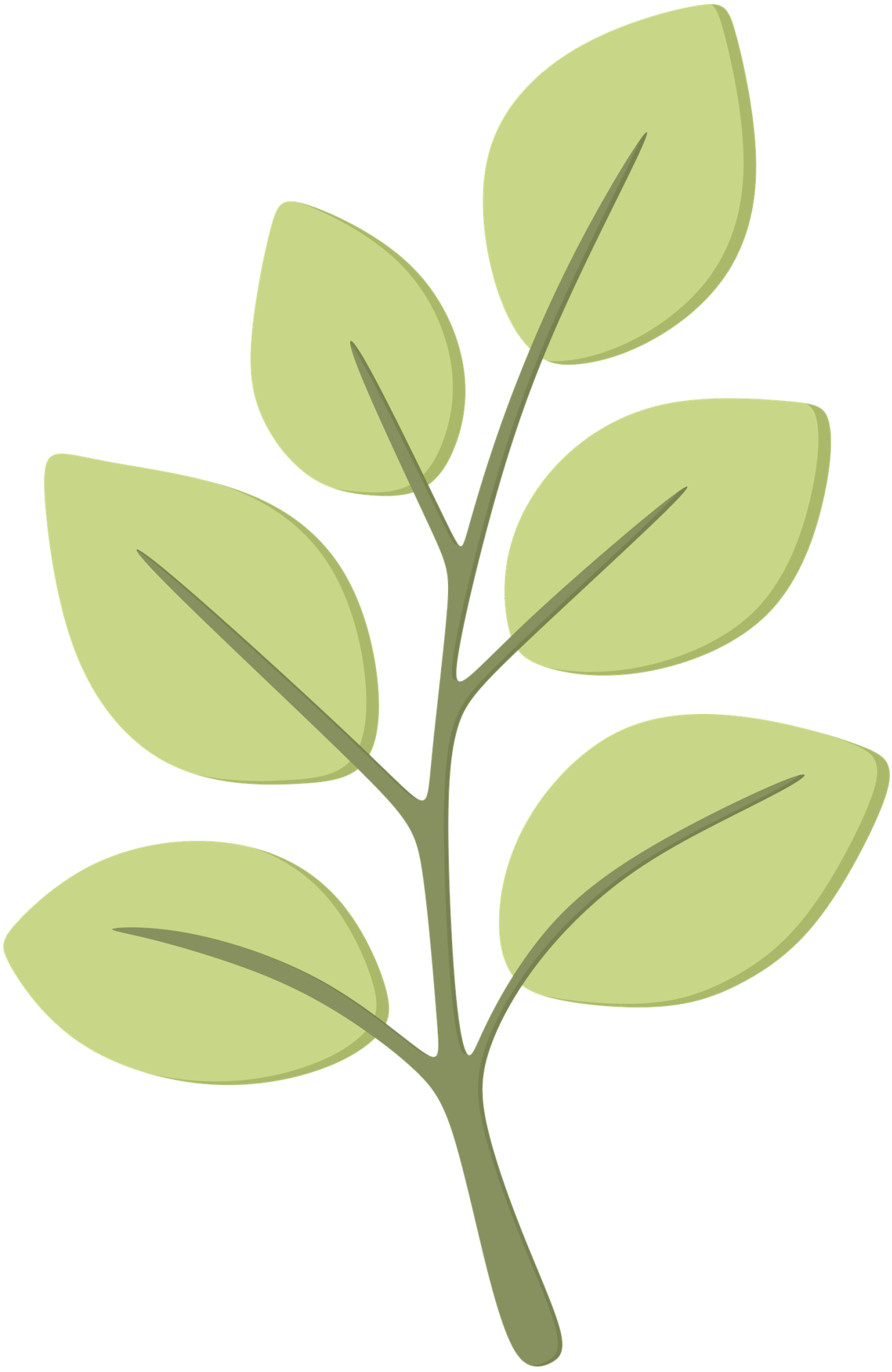












































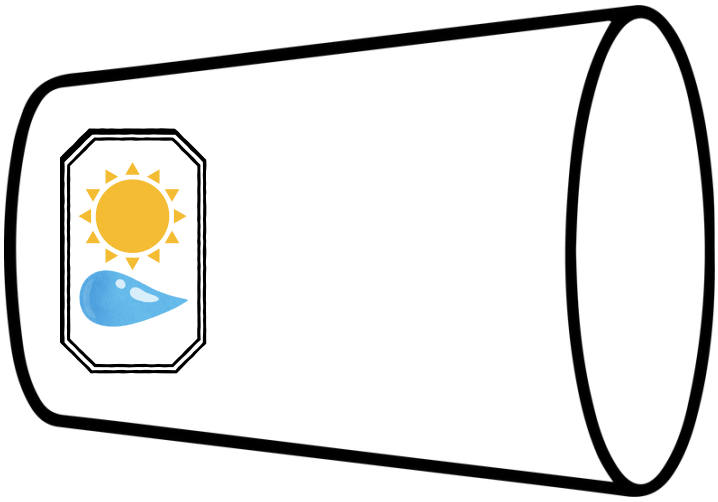


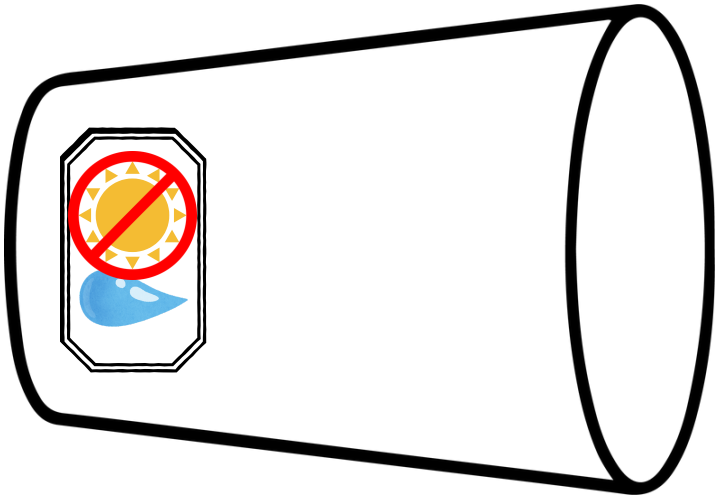


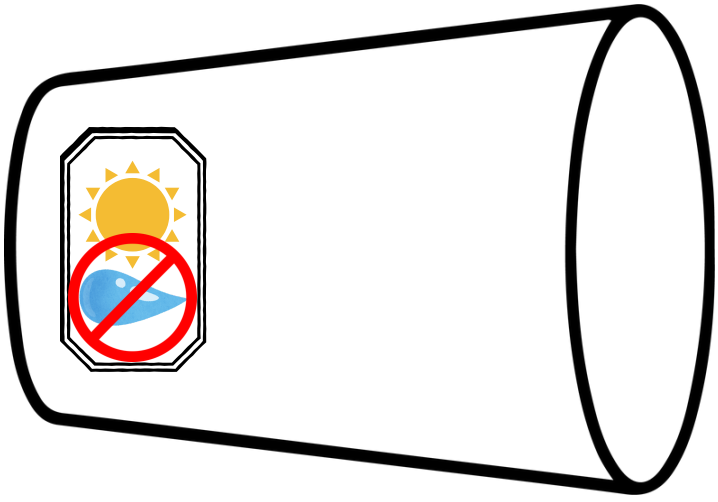










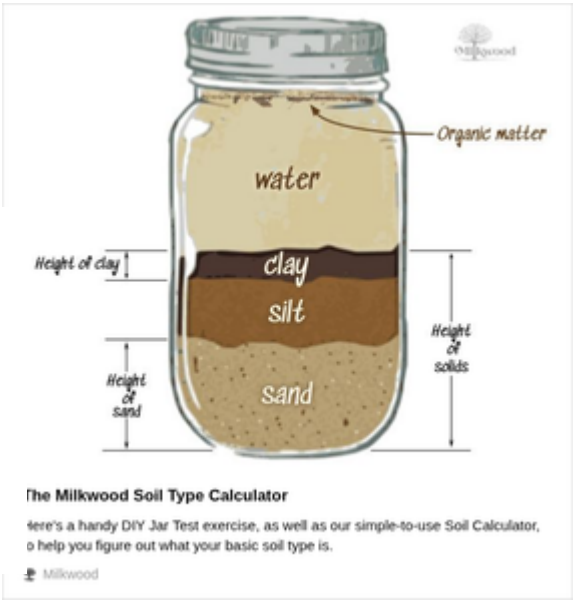
https://www.milkwood.net/soil-type-calculator/

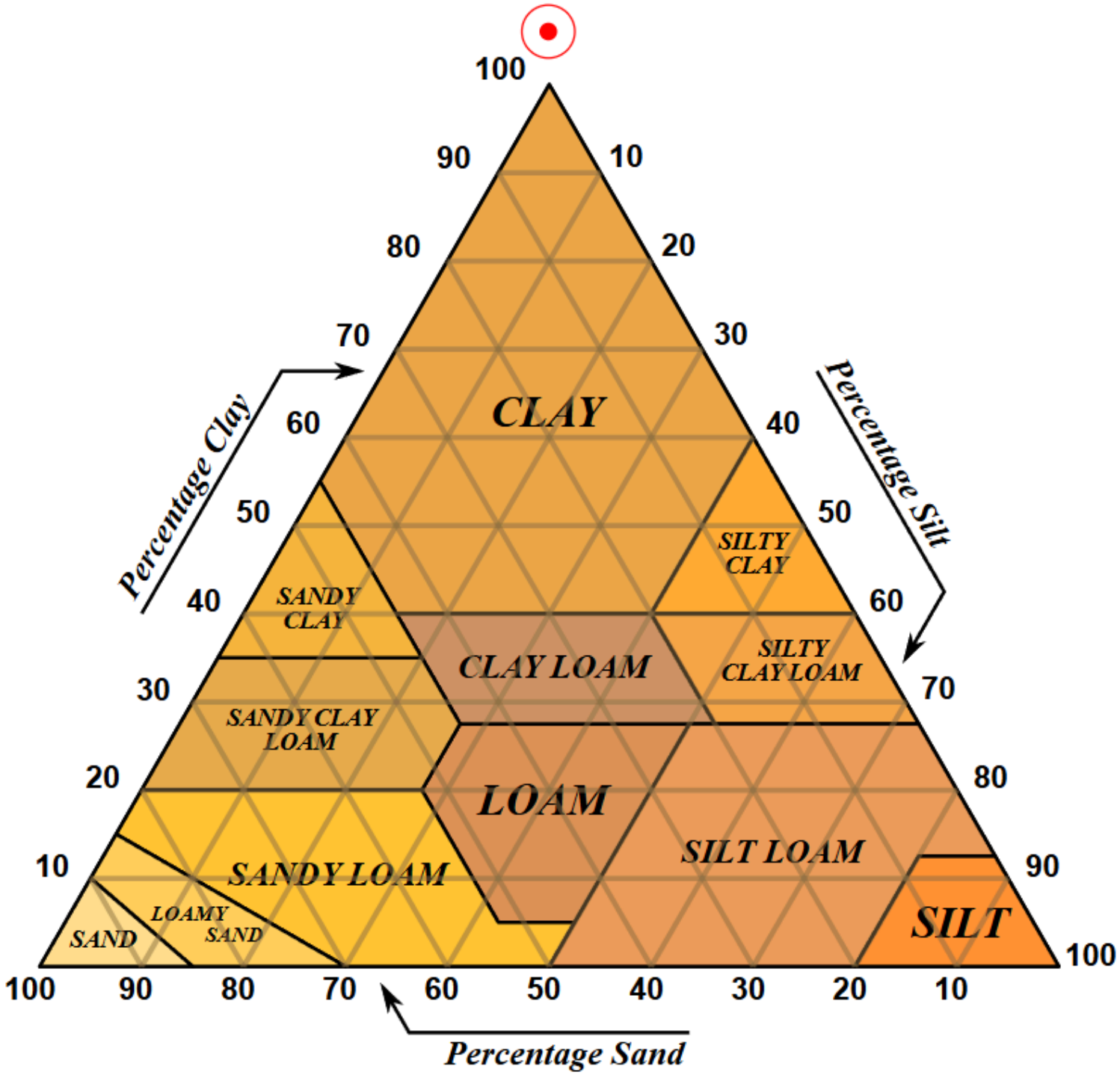
Total height of Solids: 0 mm
Total height of Clay : 0 mm
Total height of Sand : 0 mm

Therefore the total height of Silt must be: 0 mm

Your soil is 0% Clay, 0% Silt & 0% Sand.

Your soil type is indicated by the red target on the graph below.





(Milkwood, 2021)































Minute
Which of these
completed first?





