ADVENTURES IN THE PLANT KINGDOM (ALL AGES)

Ages 4 to 7 (Level 1)

Description:	Learners will explore the plant kingdom and learn about the importance of plants in our lives through different experiments and activities that will illustrate how plants behave and some of their characteristics.
Leading question:	Can you design your own plant?
Age group:	4-7
Subjects:	Science
Total time required:	4 hours over 4 days
Self-guided / Supervised activity:	High supervision
Resources required:	Pen/pencil, paper, color pencils/crayons, leaves, water, plastic/paper cups, paper towels and food coloring (optional)

Learning outcomes:	- Understanding how the plants are living things - Understanding the different parts of a plant and listing some of their functions - Understanding the general life cycle of a plant - Understanding some of the uses of plants in daily life
Required previous learning:	Ability to read and write at Kindergarten level
Inspiration:	How do plants breathe activity for kids Magical Color Transfer

Topics/concepts covered and skills developed
● Plants as living things ● Main parts of a plant and their functions ● Transportation of water in plants ● Plant life cycle ● Uses of plants for humans ● Ability to follow experimental instructions ● Art and design (creativity) skills ● Presentation and communication skills

Day	Time	Activity and Description
1	25 minutes	Learners will understand the characteristics of living things and what plants look like in different environments. Learners will explore their surroundings and look for examples of living and nonliving things from their homes or neighborhood. They will write or draw a list of

<table>
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<td>20 minutes

20 minutes

10 minutes</td>
<td>5 living and 5 nonliving things, e.g. living – dog, nonliving – book. Learners can be given prompts to encourage them to understand that plants are living things. For example, point to a houseplant, tree, bush etc. and ask the learner whether that is a living or non-living thing.

Ask learners: “How are living and nonliving things different?” Explain that everything in life can be classified as living and nonliving, and that living things have certain characteristics:
● They move
● They breathe
● They are sensitive, which means they respond to changes around them
● They grow
● They reproduce or have babies
● They eat
● They get rid of bodily waste

Learners will create the following table in their notebooks selecting 3-4 characteristics and giving examples of how living things demonstrate it. Encourage learners to use examples from the plant kingdom, but allow them to write examples from the animal kingdom if this is too challenging.

<table><tr><td>Characteristic</td><td>Living thing example</td></tr><tr><td>Moving</td><td>e.g. sunflowers moving with the sun</td></tr><tr><td>Breathing</td><td>e.g. humans breathing air</td></tr><tr><td></td><td></td></tr></table>
Learners will take a walk around their house or neighborhood with an adult and see how many plants in the form of trees, flowers, vegetables etc. they can see. They will notice the different types and sizes of plants’ leaves and flowers they find, and draw some of these in their notebook or paper. They can also create a “map” of all the trees and plants around them.

Numeracy extension:
● If you have 5 roses and 3 apples, how many plants do you have in total?
● Draw a tree with 30 leaves and write numbers 1-30 on each leaf
● If you have $10 and you bought a flower for your mother for $5, how much money do you have left?
● Make a numbered list of all the different colors you see in trees e.g. 1) brown wood, 2) green leaves, 3) pink flowers, 4) yellow fruit etc.</td>
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<tr>
<td>2</td>
<td>20 minutes</td>
<td>Learners will identify the main parts of a plant and understand ~~how plants change with time~~. the functions of the different parts of the plant

Learners will look for a plant outside or inside their homes. Learners can pull it out of the soil gently to look at the roots and then place it back gently. Explain that below the ground, plants have roots in the soil, that’s why we can’t just pick plants</td>
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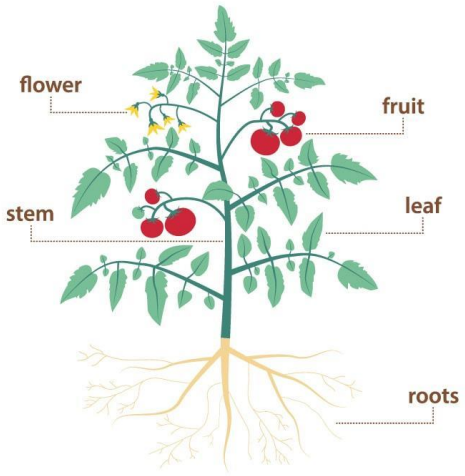
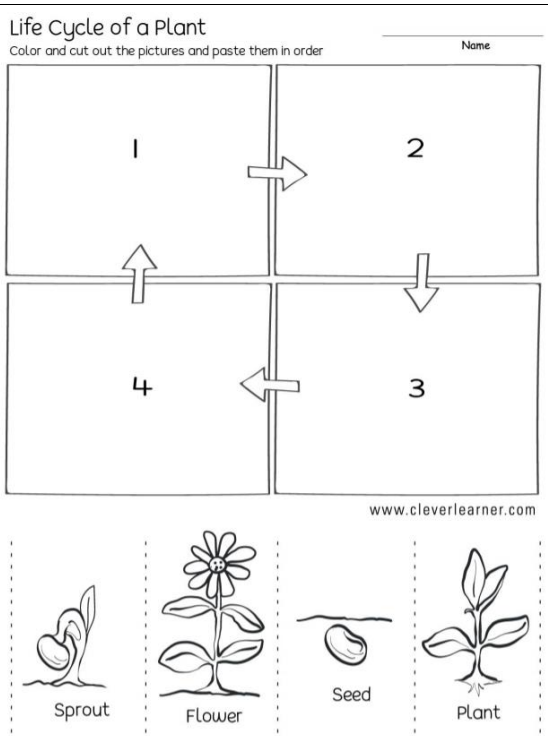
	15 minutes	easily. The long part that emerges above the ground is called a **stem**. The stem usually has **leaves**. Many plants bear **flowers** and **fruits**. If no plant is available, they can draw a flower, small plant or tree and label each part.  Source: https://www.greenandvibrant.com/parts-of-a-plant Learners will now explore the functions of each part. They will reflect on how plants, like all living things, eat and breathe. Ask the learner – how do you think plants eat? Breathe? What parts do you think help them do these things? Plants need sunlight and water to live and eat. They use the sun's energy to make their own food, but they also eat through their **roots and stem**! Learners will do the following experiment to see how plant roots absorb water: ● Place 3 clear plastic or glass cups next to each other in a line ● Add water to the first and last cup, leaving the middle cup empty ● Bring two long pieces of paper towels and twist them to create a long thick piece ● Place one end of the first paper towel in the first cup and the other end in the center cup. Do the same for the other paper towel so that the center cup has two ends of both pieces of paper towels. Your setup should look like the following:

		 ● If you have different food coloring or a colored liquids, you can pour them in the first and last cup to see a cool color change effect in the end result. You can also color or paint the two paper towels blue and yellow to see how the colors mix. ● Wait for 3 hours then come back to it. What do you think will happen? ● You will observe that the center cup has filled up with water from the other cups! This is how plant **roots** collect nutrients from the soil and deliver it to the plant for the **stem** to then take it upward.
	10 minutes	Learners can also think of the stability function of a root and how it allows the plant to stay firm in the ground. They can draw a tree and cut it out. They will then try to make it stand. They will notice that the tree falls because there is nothing attaching it to the ground. If they tape a toothpick or small stick behind it and then stick it in a cardboard or piece of paper, it will stand. This is what roots allow plants to do. This protects plants from flying away in the wind!
	15 minutes	Plants breathe through their leaves. Learners will do an experiment to observe plant **respiration** or breathing: ● Place 2-3 fresh leaves of any plant in a glass bowl, preferably shallow ● Add lukewarm water to the bowl and submerge the leaves just below the surface. Make sure they stay in this position ● Wait for 2-3 hours then come back to it. What happened? You should see small bubbles forming on top of the leaves. They might be too small, so get closer to the leaves. The bubbles indicate that plants produced oxygen from breathing.
	10 minutes	The learner will write down or draw some of the functions of different plant parts. If learners cannot write yet, they can draw a plant leaf and air to illustrate the breathing function of leaves, for example. Learners can compare some of the functions to those performed by human body parts. For example, they will draw a leaf and human nose to illustrate the parts that allow humans and plants to breathe; feet and roots can also be compared.
3		Learners will be introduced to plant life cycles and understand some of the uses of plants for humans

	10 minutes	Learners will imagine what the life cycle of a plant looks like. Prompts: ● Where do plants come from? How do we grow plants such as, for example, a flower? ● Explain that plants start out as seeds, then grow to plants gradually over time, and then they wilt or die. The life cycle of a flower is as follows: **seed -> sprout (seed with some roots coming out) -> plant (stem with leaves) -> flower.** If this is too advanced, learners will be told that the stages are seed -> small plant -> tree. ● Learners will look in their kitchen for different seeds and compare their size. This is how plants start out.
	10 minutes	Optional: Learners can try to grow their own plants by sprouting pea or bean seeds in a jar and observe growth over 2 weeks. Simply push seeds down a glass jar filled with wet paper towels or tissue paper and observe how roots come out and how the seeds grow into a plant.
	5 minutes	Learners will enact the process of plant development by laying down in fetal position covered in a blanket or cover (to represent a seed), then coming out of the cover to represent the plant after it grows. They can extend their arms gradually to represent the stem developing branches. Finally, they can tilt forward or the side to represent wilting or the end of the life cycle.
	20 minutes	Learners will create a labeled plant life cycle from seed to plant similar to the example below: ● Draw four stages of plant life for a flower – seed, sprout, plant, flower ● Color and cut out these drawings using a pair of scissors ● Draw four big boxes and label them 1-4. These should be big enough to put the drawings inside ● Decide which drawing should go on each box. The box labeled 1 should have the seed drawing inside because that is the first stage in a flower's life cycle. Continue placing the other drawings in the other boxes. You can glue, tape, or staple them in the boxes ● Label each box as seed, sprout, plant, or flower Example:



Source: http://cleverlearner.com/science/images/life-cycle-of-a-plant-preschool-worksheet.pdf

10 minutes

If this is too challenging, learners can simply draw three diagrams for the different stages of plant life – seed, small plant, tree or seed to flower for an even simpler diagram.

Learners will now think of some of the uses of plants in our lives. The learner will create the following table in their notebooks to see how plants are used in our daily lives. Learners can use the help of an adult in completing the table. They will write the plant in one column and its use in the other. An example has been done in the table below:

Plant	Use
Orange	Eating

Learners will present their table of uses of plants to humans to family members/class for feedback.
Family feedback will include:

- What they loved about the table of uses and the presentation
- What could be improved
- Any other suggestions for improvement

<table>
<tr><td></td><td></td><td>Learners will use the feedback to revise their table of uses of plants to humans</td></tr>
<tr><td>4</td><td>

20 minutes

20-30 minutes

30 minutes</td><td>

Learners will create their own plant model and share it with their family

Learners can create a typical plant like a flower or design their own plant. They can first draw a few flowers they like, then think about how to design their own flower. For their own plant, Learners will think of the following:

- A creative name for their plant
- How the plant eats
- Whether the plant has a flower or just leaves
- The colors of each part
- The kind of environment or country the plant grows in

Learners will then either draw and color the plant or create 3D models such as the following, making sure that each part of the plant is labeled (flower, stem, leaves, and root):

Learners will write one word under each label to illustrate the function of each part. For example, they can write breathing next to the leaves.

Source: https://www.pinterest.com/pin/348395721166351529/

Optional: did you know that some of the fruits and vegetables we eat come from different parts of plant? Carrots are actually roots and grow under the ground! Learners can create an edible flower model with the help of an adult to show we eat different parts of plants. Learners will look in their kitchen for examples of

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	10 minutes	vegetables and fruits that come from different parts of plants or they can purchase some of these next time they go grocery shopping. Suggestions: ● Flower: broccoli, cauliflower, artichoke, strawberries ● Stem: celery, asparagus, spring onions ● Leaves: spinach, lettuce, kale, Rocca/arugula ● Root: sweet potatoes, carrots, ginger, beetroot The learner will draw an outline of a flower and ask an adult to cut the vegetables and fruits into small parts so they can be placed on the outline as shown below. The learner may even include seeds such as pumpkin seeds, pistachios, walnuts, or cashew nuts:  Source : https://www.pinterest.com/pin/27232772726599701/ Learners will present their plant models to their family members/class for feedback. Family feedback will include: - What they loved about the plant model and the presentation - What could be improved - Any other suggestions for improvement Learners will use the feedback to revise their plant model
Assessment Criteria:		- Accurately labeled plant parts figure - Accurately labeled plant life cycle figure - Critical thinking in identifying plant uses in daily life - Creative and labeled 3D or 2D plant model - Reflection on the differences between different types of plants

Additional enrichment activities:	- Learners can do an experiment to observe how the stem transports water upward. Place a lettuce leaf in a cup filled with

	colored liquid (or add food coloring to water). Observe how the leaf turns into the color of the liquid after a few hours. - Learners can experiment with 3 different set ups to see what plants need to grow. They will insert a wet paper towel in 2 jars and place a seed inside each one. In another jar, they will place dry paper towels. They will then place one of the jars with wet paper towels and the jar with dry paper towels in the sun, and leave one of the jars with wet paper towels in a dark place. Learners will check back in a week to see the progress of the seeds. They will find that the jar with water which was placed in the sun was the only one that grew a sprout, which means that water and light are necessary for plant growth.
Modifications for simplification	Learners can limit the activities to a labeled figure of plant parts and write a few words to signify the different uses humans have for plants and finally designing their own plant.

Ages 8 to 10 (Level 2)

Description:	Learners will explore the plant kingdom and learn about the importance of plants in our lives through different experiments and activities that will illustrate how plants behave and some of their characteristics.
Leading question:	Can you design your own plant?
Age group:	8-10
Subjects:	Science
Total time required:	5.8 hours over 5 days
Self-guided / Supervised activity:	Medium supervision
Resources required:	Pen/pencil, paper, color pencils/crayons, scissors, 6 plastic bottles or 3 plastic bottles and 3 paper cups/small lightweight bowls, plant with roots, soil, leaves, water, string/thread, jar, seed, paper towels, and food coloring (optional)

Learning outcomes:	- Understanding the different parts of a plant and listing some of their functions compared to human body parts - Understanding the general life cycle of a plant - Understanding some of the uses of plants in daily life - Understanding the causes of desertification and the role of plants
Required previous learning:	
Inspiration:	How do plants breathe activity for kids Magical Color Transfer

Topics/concepts covered and skills developed
- Plants as living things - Adaptations of plants to their environments - Functions of different plant parts - Plant life cycle - Uses of plants to humans - Desertification and role of plats in protecting the soil - Ability to follow experimental instructions - Art and design skills - Presentation and communication skills -

<table>
<tr><th>Day</th><th>Time</th><th>Activity and Description</th></tr>
<tr><td>1</td><td>

15 minutes

20 minutes

20 minutes</td><td>Learners will understand the characteristics of living things and how plants adapt to their environment.

Learners will explore their surroundings and look for examples of living and nonliving things from their homes or neighborhood. They will write a list of 10 living and 10 nonliving things, e.g. living – dog, nonliving – book. Learners can be given prompts to encourage them to understand that plants are living things. For example, point to a houseplant, tree, bush etc. and ask the learner whether that is a living or nonliving thing.

Ask learners: “In what ways are living and nonliving things different?” Explain that everything in life can be classified as living and nonliving, and that living things have certain characteristics:
● They move
● They breathe
● They are sensitive, which means they respond to changes around them
● They grow
● They reproduce
● They eat
● They get rid of waste

Learners will create the following table in their notebooks and give examples of how living things demonstrate all these characteristics. Encourage learners to use examples from the plant kingdom.

<table><tr><td>Characteristic</td><td>Living thing example</td></tr><tr><td>Moving</td><td>e.g. sunflowers moving with the sun</td></tr><tr><td>Breathing</td><td>e.g. humans breathing air</td></tr><tr><td></td><td></td></tr></table>
Learners will reflect on the different types of plants they know and list some of them, making sure to diversify examples to include trees, flowers, vegetables etc.

Learners will then draw some plants they are familiar with from their own city or country, as well as examples of other plants that grow in at least 3 other different environments. Ask learners: “how are these plants different from each other?” Learners can see appendix 1 for examples. Example:

<table><tr><td>Plant</td><td>Environment</td></tr></table></td></tr>
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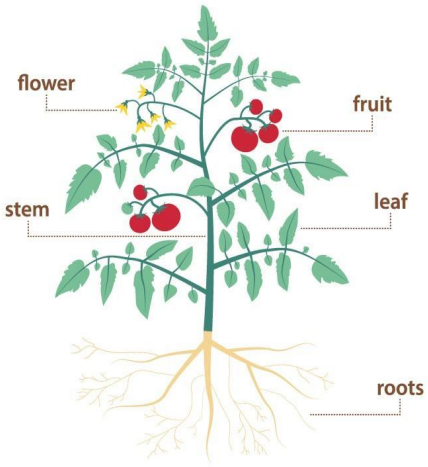
	15 minutes	  Note: if this is too challenging, learners can simply create a “map” of all the trees or plants around them. Numeracy extension: ● If there are only 2 parks in a city and each has 32 trees, how many trees does the city have in total? ● A forest has 100 trees. The local furniture factory cuts down 3 trees and plants 5 trees in this forest. How many trees does the forest now have? ● If you have $40 and flowers cost $2 each, how many flowers can you buy for your mother?
2	20 minutes	Learners will identify the main parts of a plant and understand the functions of the different parts of the plant Ask learners: “can you draw or name the different parts of a plant?” Learners will look for a plant outside or inside their homes. Learners can pull it out of the soil gently to look at the roots and then place it back gently. Explain that below the ground, plants have **roots** in the soil, that’s why we can’t just pick plants easily. The long part that emerges above the ground is called a **stem**. The stem usually has **leaves**. Many plants bear **flowers** and **fruits**. If no plant is available, they can draw a flower, small plant or tree and label each part. 

	15 minutes	Source: https://www.greenandvibrant.com/parts-of-a-plant Learners will now explore the functions of each part. They will reflect on how plants, like all living things, eat and breathe. Ask the learner – how do you think plants eat? Breathe? What parts do you think help them do these things? Plants need sunlight and water to live and eat. They use the sun's energy to make their own food, but they also eat through their **roots and stem**! Learners will do the following experiment to see how plant roots absorb water: ● Place 3 clear plastic or glass cups next to each other in a line ● Add water to the first and last cup, leaving the middle cup empty ● Bring two long pieces of paper towels and twist them to create a long thick piece ● Place one end of the first paper towel in the first cup and the other end in the center cup. Do the same for the other paper towel so that the center cup has two ends of both pieces of paper towels. Your setup should look like the following:  ● If you have different food coloring or colored liquids, you can pour them in the first and last cup to see a cool color change effect in the end result. You can also color or paint the two paper towels blue and yellow to see how the colors mix. ● Wait for 3 hours then come back to it. What do you think will happen? ● You will observe that the center cup has filled up with water from the other cups! This is how plant **roots** collect nutrients from the soil and deliver it to the plant for the **stem** to then take it upward.
	10 minutes	Learners can also think of the stability function of a root and how it allows the plant to stay firm in the ground. They can draw a tree and cut it out. They will then try to make it stand. They will notice that the tree falls because there is nothing attaching it to the ground. If they tape a toothpick or small stick behind it and then stick it in a cardboard or piece of paper, it will stand. This is what roots allow plants to do. This protects plants from flying away in the wind!
	15 minutes	Ask learners - how do you think plants breathe? Learners will do an experiment to observe plant **respiration** or breathing through the leaves: ● Place 2-3 fresh leaves of any plant in a glass bowl, preferably shallow

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Add lukewarm water to the bowl and submerge the leaves just below the surface. Make sure they stay in this position
Wait for 2-3 hours then come back to it. What happened? You should see small bubbles forming on top of the leaves. They might be too small, so get closer to the leaves. The bubbles indicate that plants produced oxygen from breathing.

To recap:

Roots provide stability and collect nutrients from the soil
The stem transports nutrients upward from the root to the rest of the plant
Leaves use sunlight and the nutrients collected by the root and transported by the stem to make food for the plant (in the form of glucose, which is a type of sugar like the one we eat)

The learner will write down or draw some of the functions of different plant parts and compare them to human body parts responsible for those functions.
<table>
<tr><td>Function</td><td>Plant part</td><td>Human body part</td></tr>
<tr><td>e.g. Breathing</td><td>Leaves</td><td>Lungs, nose</td></tr>
<tr><td></td><td></td><td></td></tr>
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<td>3</td>
<td>10 minutes</td>
<td>Learners will be introduced to plant life cycles and understand some of the uses of plants for humans

Learners will imagine what the life cycle of a plant looks like. Prompts:

Where do plants come from? How do we grow plants, for example, a flower?
After a plant grows out of the soil, what happens to it? How long does it stay in that form?
How does a plant change with time?
Explain that plants start out as seeds, then grow to plants gradually over time, and then they wilt or die. We call plants growing from seeds germination or sprouting. The life cycle of a flower is as follows: seed -> root comes out of seed -> seedling grows out of the ground -> stem and leaves grow -> flowers grow -> flowers make fruits/vegetables and seeds

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<td>5 minutes</td>
<td>Learners will enact the life cycle of any plant of their choice by lying down in fetal position covered in a blanket or cover (to represent a seed), then coming out of the cover to represent the plant after it grows. They can extend their arms gradually to represent the stem developing branches. Finally, they can tilt forward or the side to represent wilting or the end of the life cycle.</td>
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<td>20 minutes</td>
<td>Learners will create a labeled plant life cycle illustration from seed to plant:

Draw the stages of plant life for a flower – 1. Seed, 2. Rooting seed, 3. Small plant with leaves, 4. adult plant with flowers and fruit/vegetables

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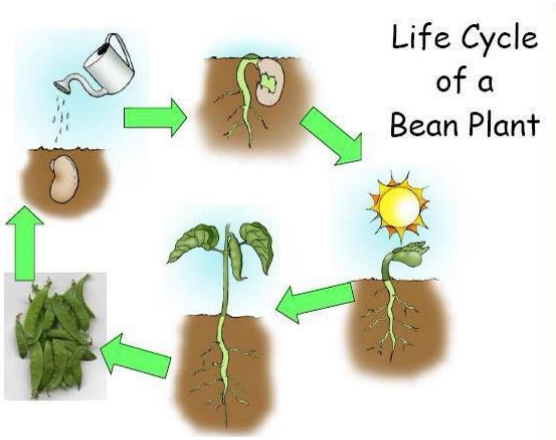
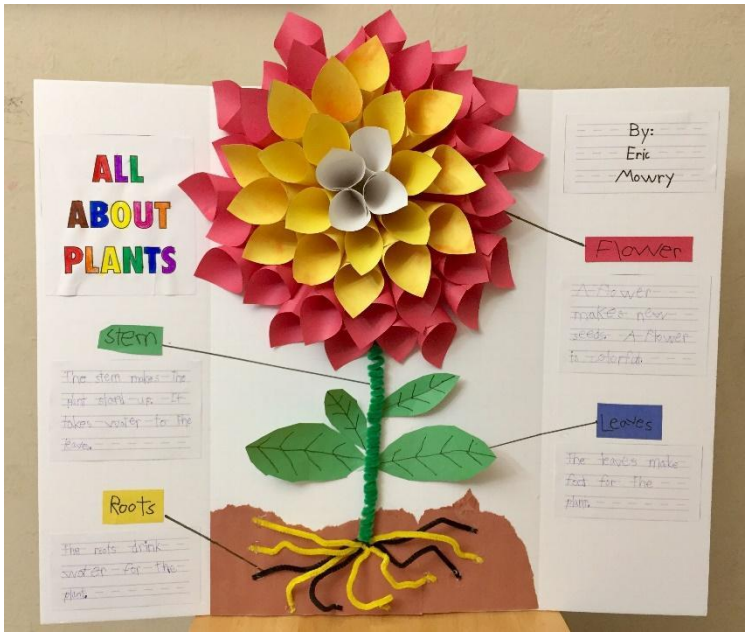
</table>

	20 minutes	• Color and cut out these drawings using a pair of scissors • Draw four big boxes and label them 1-4. These should be big enough to put the drawings inside • Decide which drawing should go on each box. The box labeled 1 should have the seed drawing inside because that is the first stage in a flower's life cycle. Continue placing the other drawings in the other boxes. You can glue, tape, or staple them in the boxes • Next to each box, write a sentence about this stage of a plant's life  Source: https://www.tes.com/lessons/RabEFf__WxRBnw/life-cycle-of-a-bean Note: Learners can choose to simply draw a labeled diagram of the life cycle of any plant of their choice. Learners will present their labeled plant life cycle to family members/class for feedback. Feedback will include: - What they loved about it - What could be improved - Any other suggestions for improvement Learners will use the feedback to revise their labeled plant life cycle Learners will observe the life cycle of a plant firsthand! They will try to grow their own plants by sprouting pea or bean seeds in a jar and observe growth over 2 weeks: • Bring a glass jar, some paper towels/cotton, water and a seed of a plant like mung, beans or peas • Fill the jar with wet paper towels or tissue paper but make sure that the jar itself is not filled with too much water • Push the seeds down between the tissues and bring it to the side of the jar so you can have a clear view of how it grows • What do you think will happen? Observe how after two weeks, roots start to come out and how the seeds grow into a plant!

	20 minutes	 Source: https://littlebinsforlittlehands.com/seed-jar-science-experiment-kids/ Note: learners may also plant the seeds in soil if that is available Learners will now think of some of the uses of plants in our lives. The learner will write a paragraph or poem/short story about how plants are used in our daily lives – from when we wake up to when we go to bed. Learners can walk around the house for inspiration and use the help of an adult in understanding the different ways we use plants. Some of the many uses of plants are: ● Breathing – plants make the air we breathe! ● Eating – we eat fruits and vegetables, which are plants ● Clothing – cotton in our clothes comes from plants Learners will present it to family members/class for feedback. Feedback will include: - What they loved about the poem/story - What could be improved - Any other suggestions for improvement Learners will use the feedback to revise their poem
4	10 minutes 10 minutes 30 minutes	Learners will learn about desertification and the role of plants in protecting the soil Ask learners - did you know that green areas of land can turn into deserts? Why do you think that happens? Explain that **desertification** is the loss of green areas of land and expansion of desert area. Many factors contribute to desertification including overgrazing (when animals eat all the plants), droughts, and deforestation (when plants are cut in forests without replacing them). When these things happen, a natural process called **soil erosion** is accelerated. Soil erosion is the removal of the top layer of the soil. Ask learners - what do you think are some causes of soil erosion? Learners can think of the different ways soil erodes naturally and write a list of 3-5 points. For example, soil drifting with rain, human cutting trees (deforestation) etc. Learners will do an experiment to demonstrate deforestation and soil erosion:

		• Cut the side of three large plastic bottles vertically leaving the neck intact so that the bottles can serve as a horizontal container • Cut three smaller water bottles horizontally and set aside their bottom half or use three small lightweight plastic bowls or paper/plastic cups. Tape, staple or tie a string so that these pieces can be held like small buckets • Place the large bottles that were cut open horizontally on a table with the cut side facing up and fill the first and second one with soil. Add a thick layer of dead or fresh leaves to one of these bottles and leave the other one with just soil. • Place a plant with its soil in the last bottle. You can use a home potted plant or take a plant from outside your house making sure that you do not pull it by the root and make sure to take part of its soil with it • Now you should have three large bottles cut open from one side with only soil in one bottle, soil and leaves in another bottle, and a plant with its roots and some soil in the last. • Hang the small bowls or buckets by their string from the neck of each bottle as shown below • Ask learners - what do you think will happen when we pour water in each of these bottles? What do you think will come out? Learners write their guesses down • Pour water from a container into each bottle and watch what comes out into the little buckets. Write your observations in your notebook and compare them to your guesses. • You will notice that the water from the first bottle is filled with soil, while that from the one with leaves has very little soil, and the one with plants is clear! • Why do you think this happened? This is because plant roots hold and protect the soil from erosion. Do you see how the roots are entangled in the soil when you lift the plant up? When **desertification** happens, **soil erosion** happens at a very fast rate because plants are not there to protect it!  Source: https://www.youtube.com/watch?v=im4HVXMGI68

	20 minutes	Note: Learners can simplify this activity by placing a potted plant or rooted plant with soil in a container temporarily and poking a hole in the container. They can then pour water through the container to see how clear water comes out, which indicates that roots hold the soil together and do not allow water to wash it away. They will compare this with a container that has only soil and notice how a lot of the soil comes out with the water, which is similar to how soil erosion through rainfall occurs. The learner will draw a before and after image of a forest where desertification has occurred. He or she will also write a paragraph about what should be done to reverse the damage to this area. For example, planting more trees. Learners will share with the family members/class what they think can be done to reverse desertification for feedback and additional input.
5	10 minutes 20-30 minutes	Learners will design their own plant! They can create a typical plant like a flower or design their own imaginary plant with special characteristics! Learners will think of the following: ● A creative name for their plant ● How the plant eats ● Whether the plant has a flower or just leaves ● The colors of each part ● The kind of environment or country the plant grows in Learners will then either draw and color the plant or create 3D models such as the following. Learners will label the model and write 2 sentences about each part of the plant describing its function:  Source: https://www.pinterest.com/pin/348395721166351529/

	30 minutes	Optional: did you know that some of the fruits and vegetables we eat come from different parts of plant? Carrots are actually the roots and grow under the ground! Learners can create an edible flower model with the help of an adult to show we eat different parts of plants. Learners will look in their kitchen for examples of vegetables and fruits that come from different parts of plants or they can purchase some of these next time they go grocery shopping. Suggestions: ● Flower: broccoli, cauliflower, artichoke, strawberries ● Stem: celery, asparagus, spring onions ● Leaves: spinach, lettuce, kale, Rocca/arugula ● Root: sweet potatoes, carrots, ginger, beetroot The learner will draw an outline of a flower and ask an adult to cut the vegetables and fruits into small parts so they can be placed on the outline as shown below. The learner may even include seeds such as pumpkin seeds, pistachios, walnuts, or cashew nuts:  Source : https://www.pinterest.com/pin/27232772726599701/
	10 minutes	Learners will present their model(s) with their families/class and quiz them on plant facts! Feedback will include: - What they loved about the plant model and the presentation - What could be improved - Any other suggestions for improvement Learners will use the feedback to revise their plant model
Assessment Criteria:		- Accurately labeled plant parts figure - Accurately labeled plant life cycle figure - List of plant uses in daily life

	- Creative and labeled 3D or 2D plant model

Additional enrichment activities:	- Learners can do an experiment to observe how the stem transports water upward. Place a lettuce leaf in a cup filled with colored liquid (or add food coloring to water). Observe how the leaf turns into the color of the liquid after a few hours. - Learners can observe the cycle of reproduction of flowering plants by cutting open a selection of fruits and examining the seeds. They can also plant seeds and observe their germination and growth.
Modifications for simplification	Learners can limit the activities to one essay containing a labeled figure of plant parts, the functions of all these parts and some different uses humans have for plants.

Ages 11 to 14 (Level 3)

Description:	Learners will explore the plant kingdom and learn about the importance of plants in our lives through different experiments and activities that will illustrate how plants behave and some of their characteristics.
Leading question:	Can you design your own plant?
Age group:	11-14
Subjects:	Science
Total time required:	7 hours over 5 days
Self-guided / Supervised activity:	Low supervision
Resources required:	Pen/pencil, paper, color pencils/crayons, scissors, 6 plastic bottles or 3 plastic bottles and 3 paper cups/small lightweight bowls, plant with roots, soil, leaves, water, string/thread, jar, seed, paper towels, and food coloring (optional)

Learning outcomes:	- Understanding the different parts of a plant and listing some of their functions compared to human body parts - Understanding the general life cycle of a plant - Understanding some of the uses of plants in daily life - Understanding of the role of osmosis in transport in plants - Understanding of the role of plants in desertification
Required previous learning:	
Inspiration:	- How do plants breathe activity for kids - Magical Color Transfer - Osmosis in Potato Strips - Bio Lab

Topics/concepts covered and skills developed
● Characteristics of living things ● Adaptation of plants to their environment ● Parts of a plant and their functions ● Transportation of water and nutrients in plants ● Respiration in plants ● Plant life cycle ● Uses of plants for humans ● Requirements for plant growth ● Desertification and role of plants in protecting the soil ● How plant cells absorb water through osmosis ● Ability to follow experimental instructions

- Art and design (creative) skills
- Presentation and communication skills

<table>
<tr><th>Day</th><th>Time</th><th>Activity and Description</th></tr>
<tr><td>1</td><td></td><td>Learners will understand the characteristics of living things and how plants adapt to their environment.</td></tr>
<tr><td></td><td>10 minutes</td><td>Learners will explore their surroundings and look for examples of living and nonliving things from their homes or neighborhood. They will write a list of 10 living and 10 non-living things, e.g. living – dog, nonliving – book. Learners can be given prompts to encourage them to understand that plants are living things. For example, point to a houseplant, tree, bush etc. and ask the learner whether that is a living or nonliving thing.</td></tr>
<tr><td></td><td>20 minutes</td><td>Ask learners to list a few differences between living and nonliving things. Explain that everything in life can be classified as living and nonliving, and that living things fall into either the animal kingdom (Kingdom Animalia) or the plant kingdom (Kingdom Plantae) and have certain characteristics:
They move
They breathe
They are sensitive
They grow
They reproduce
They eat
They get rid of waste</td></tr>
<tr><td></td><td>10 minutes</td><td>Learners will create the following table in their notebooks and give examples of how living things demonstrate all these characteristics from both plantae and Animalia.<table><tr><th>Characteristic</th><th>Kingdom Plantae example</th><th>Kingdom Animalia example</th></tr><tr><td>Moving</td><td>e.g. sunflowers moving with the sun</td><td>human walking</td></tr><tr><td>Breathing</td><td>e.g. tree leaves breathing</td><td>dog breathing</td></tr><tr><td></td><td></td><td></td></tr></table>Learners will reflect on how different plants adapted to their environments and list or draw some examples of these. Ask them: what do you think helps plants survive in different climates and environments? For example, plants that grow in harsh climates with little rainfall need less water to survive because they store the little rainfall they do get for later use. They can compare it to how different animals adapt</td></tr>
</table>

<table>
<tr>
<td></td>
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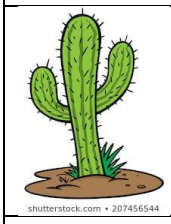
<td>to their environments. For example, camels store water to cope with the harsh desert climate with little rainfall, just like a cactus does! There are many examples of adaptation in nature. For example, some plants attract bees for pollination (which helps them reproduce) through their scent. Others like the Venus Flytrap eat insects because there aren’t enough nutrients in the soil in the places it grows!

Learners will then draw some plants they are familiar with from their own surroundings, as well as examples of other plants that grow in at least 3 other different environments. Learners can see appendix 1 for examples of some adaptations and then identify and draw the plants that have these adaptations. Example:

<table>
<tr><th>Plant</th><th>Environment</th><th>Adaptation</th></tr>
<tr><td>  </td><td>  </td><td>Can store water</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

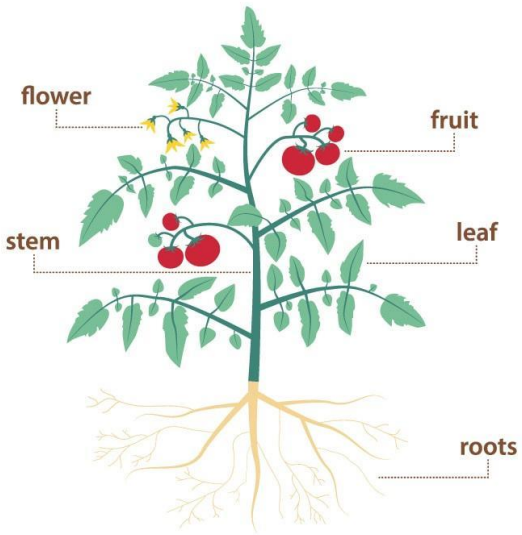
Numeracy extension:

A furniture factory cuts down 3 trees per month and plants 5 in the same forest. If the forest had 100 trees at the beginning of January, how many trees will it have by the end of that month?
If you have $40 and flowers cost $2.25 each, how many flowers can you buy for your mother?
Advanced option: Mariam wants to make a wooden pot for her plants that is 30 cm^3. If she makes the height 5 cm and the length 2 cm, how wide should she make her pot? (Hint: volume of a rectangular prism is length x width x height. Here, the volume is 30 cubic centimeters and you are given the height and length. Find the width using the formula volume = l x w x h)

</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Learners will identify the main parts of a plant and understand their functions.

Learners will look for a small plant outside or inside their homes and pull it or raise it gently so that they can return it to the soil after the activity. They will identify the roots, stem, leaves, flower, and fruit. Explain that roots anchor the plant, which is why we cannot just pick plants easily. This protects plants from flying away by strong winds. They also collect water and nutrients from the soil. The stem is responsible for transporting nutrients collected by the roots upward to the rest of the plant. The leaves are responsible for respiration or breathing. Many plants bear flowers and fruits.

If no plant is available, learners can draw a flower, small plant or tree from their imagination or any printed or visual source, making sure to label each part.</td>
</tr>
</table>

		 Source: https://www.greenandvibrant.com/parts-of-a-plant
	15 minutes	Learners will now explore the functions of each part. They will reflect on how plants, like all living things, eat and breathe. Ask the learner – how do you think plants eat? Breathe? What parts do you think help them do these things? Plants need sunlight and water to live and eat. They use the sun's energy to make their own food, but they also eat through their **roots and stem**! Learners will do the following experiment to see how plant roots absorb water: ● Place 3 clear plastic or glass cups next to each other in a line ● Add water to the first and last cup, leaving the middle cup empty ● Bring two long pieces of paper towels and twist them to create a long thick piece ● Place one end of the first paper towel in the first cup and the other end in the center cup. Do the same for the other paper towel so that the center cup has two ends of both pieces of paper towels. Your setup should look like the following: 

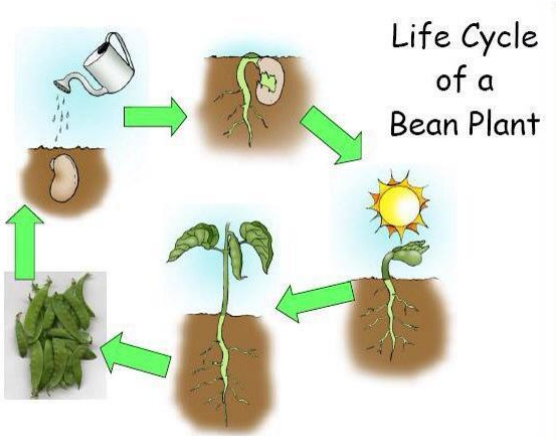
		• If you have different food coloring or colored liquids, you can pour them in the first and last cup to see a cool color change effect in the end result. You can also color or paint the two paper towels blue and yellow to see how the colors mix. • Wait for 3 hours then come back to it. What do you think will happen? • You will observe that the center cup has filled up with water from the other cups! This is how plant **roots** collect nutrients from the soil and deliver it to the plant for the **stem** to then take it upward.
	10 minutes	Learners can also think of the stability function of a root and how it allows the plant to stay firm in the ground. They can draw a tree and cut it out. They will then try to make it stand. They will notice that the tree falls because there is nothing attaching it to the ground. If they tape a toothpick or small stick behind it and then stick it in a cardboard or piece of paper, it will stand. This is what roots allow plants to do. This protects plants from flying away in the wind!
	10 minutes	Learners can do an experiment to observe how the **stem** transports water and nutrients upward: • Place a lettuce leaf in a cup filled with colored liquid like orange juice (or add food coloring or powders like beetroot, paprika etc. to water). • Observe how the leaf turns into the color of the liquid after 2-3 hours. • Learners can try to provide their own explanation for why we observe this change – how does the stem transport nutrients to the rest of the plant? • If possible, explain that this is possible because of the **xylem** and **phloem** cells within the stem of a flowering plant, which are like tubes that transport moisture and nutrients from the root upward to the rest of the plant.
	15 minutes	Plants breathe through their leaves. Learners will do an experiment to observe plant **respiration** or breathing and waste removal: • Place 2-3 fresh leaves of any plant in a glass bowl, preferably shallow • Add lukewarm or hot water to the bowl and submerge the leaves just below the surface. Make sure they stay in this position • Wait for 2-3 hours then come back to it. What happened? You should see small bubbles forming on top of the leaves. They might be too small, so get closer to the leaves. The bubbles indicate that plants produced oxygen from breathing. • Learners can try to write a few sentences explaining their own understanding for what they observe – how do plants breathe? • If possible, explain that there are small pores like your facial pores on the surface of leaves called the stomata. These are responsible for regulating gas exchange in plants. They take in carbon dioxide and release oxygen (seen in the experiment as bubbles) as a “waste” byproduct of photosynthesis

<table>
<tr><td></td><td>10 minutes</td><td>This experiment also demonstrates the process by which plants make their food – or photosynthesis – where they take in carbon dioxide, water, and light, and create glucose and oxygen. The bubbles formed represent the oxygen created.

Optional: Learners can draw a diagram of photosynthesis in nature showing the natural sources of light, water, and carbon dioxide and writing an equation that shows that carbon dioxide (CO_2) and water (H_2O) give glucose ($C_6H_{12}O_6$) and oxygen (O_2).

To recap:
Roots provide stability and collect nutrients from the soil
The stem transports nutrients upward from the root to the rest of the plant through the xylem and phloem cells that are present inside of it
Leaves use sunlight and the nutrients collected by the root and transported by the stem to make food for the plant (in the form of glucose, which is a type of sugar like the one we eat). Leaves control the respiration function through their pores (stomata) and other parts present inside their cells</td></tr>
<tr><td></td><td>10 minutes</td><td>The learner will write down some of the functions of different plant parts and compare them to human body parts responsible for those functions.

<table><tr><td>Function</td><td>Plant parts</td><td>Human body part</td></tr><tr><td>e.g. Breathing</td><td>Leaves, stomata</td><td>Lungs, nose</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table></td></tr>
<tr><td></td><td>15 minutes</td><td>The learner will write a paragraph on the following prompt in the first person: “Imagine you are a plant that grows in a forest or jungle/rainforest. Describe what you might look like and what each one of your parts might be doing to protect you on a particularly rainy day.”</td></tr>
<tr><td>3</td><td></td><td>Learners will be introduced to plant life cycles and understand some of the uses of plants for humans</td></tr>
<tr><td></td><td>20 minutes</td><td>Learners will imagine what the life cycle of a plant looks like. Prompts:
Where do plants come from? How do we grow plants, for example, a flower?
After a plant grows out of the soil, what happens to it? How long does it stay in that form?
How does a plant change with time?
Explain that plants start out as seeds, then grow to plants gradually over time, and then they wilt or die. We call the process of plants growing from seeds germination or sprouting. The life cycle of a flower is as follows: seed -> root comes out of seed -> seedling grows out of the ground -> stem and leaves grow -> flowers grow -> flowers make fruits/vegetables and seeds</td></tr>
</table>

	20 minutes	Learners will create a labeled plant life cycle from seed to plant: ● Draw the stages of plant life for a flower – 1. Seed, 2. Rooting seed, 3. Small plant with leaves, 4. adult plant with flowers and fruit/vegetables ● Color and cut out these drawings using a pair of scissors ● Draw four big boxes and label them 1-4. These should be big enough to put the drawings inside ● Decide which drawing should go on each box. The box labeled 1 should have the seed drawing inside because that is the first stage in a flower's life cycle. Continue placing the other drawings in the other boxes. You can glue, tape, or staple them in the boxes ● Next to each box, write a sentence about this stage of a plant's life  Source: https://www.tes.com/lessons/RabEFf__WxRBnw/life-cycle-of-a-bean
	20 minutes	Learners will present their labeled plant life cycle to family members/class for feedback. Feedback will include: - What they loved about it - What could be improved - Any other suggestions for improvement Learners will use the feedback to revise their labeled plant life cycle Learners will observe the life cycle of a plant firsthand! They will try to grow their own plants by sprouting pea or bean seeds in a jar and observe growth over 2 weeks: ● Bring a glass jar, some paper towels, water and a seed of a plant like beans or peas ● Fill the jar with wet paper towels or tissue paper but make sure that the jar itself is not filled with too much water ● Push the seeds down between the tissues and bring it to the side of the jar so you can have a clear view of how it grows

		• What do you think will happen? Observe how after two weeks, roots start to come out and how the seeds grow into a plant! • Create a table and enter your daily observations on how you see the seed changing. • Learners can experiment with 3 different set ups to see what plants need to grow. They will create the same set up in a different jar and in another jar, they will place dry paper towels so that they have 3 separate jars. They will then place one of the jars with wet paper towels and the jar with dry paper towels in the sun or next to a source of light, and leave one of the jars with wet paper towels in a dark place. Learners will check back in 1-2 weeks to see the progress of the seeds. They will find that the jar with water which was placed in the sun/light was the only one that grew a sprout, which means that water and light are necessary for plant growth. • Write a paragraph about what plants need to grow  Source: https://littlebinsforlittlehands.com/seed-jar-science-experiment-kids/
	20 minutes	Learners will now think of some of the uses of plants in our lives. The learner will write a paragraph or poem about how plants are used in our daily lives – from when we wake up to when we go to bed. Learners can walk around the house for inspiration and use the help of an adult in understanding the different ways we use plants. Some of the many uses of plants are: • Breathing – plants make the air we breathe! • Eating – we eat fruits and vegetables, which are plants • Clothing – cotton in our clothes comes from plants
4		Learners will learn about desertification and the role of plants in protecting the soil
	10 minutes	Ask learners - did you know that green areas of land can turn into deserts? Why do you think that happens? Explain that **desertification** is the loss of green areas of land and expansion of desert areas. Many factors contribute to desertification including overgrazing (when animals eat all the plants), droughts, and deforestation (when plants are cut in forests without replacing them). When these things happen, a natural process called **soil erosion** is accelerated. Soil erosion is the removal of the top layer of the soil. Ask learners - what do you think are some causes of soil erosion?
	10 minutes	
	30 minutes	Learners can think of the different ways soil erodes naturally and write a list of 3-5 points. For example, soil drifting with rain, humans cutting trees (deforestation) etc.

		Learners will do an experiment to demonstrate deforestation and soil erosion: ● Cut the side of three large plastic bottles vertically leaving the neck intact so that the bottles can serve as a horizontal container ● Cut three smaller water bottles horizontally and set aside their bottom half or use three small lightweight plastic bowls or paper/plastic cups. Tape, staple or tie a string so that these pieces can be held like small buckets ● Place the large bottles that were cut open horizontally on a table with the cut side facing up and fill the first and second one with soil. Add a thick layer of dead or fresh leaves to one of these bottles and leave the other one with just soil. ● Place a plant with its soil in the last bottle. You can use a home potted plant or take a plant from outside your house making sure that you do not pull it by the root and make sure to take part of its soil with it ● Now you should have three large bottles cut open from one side with only soil in one bottle, soil and leaves in another bottle, and a plant with its roots and some soil in the last. ● Hang the small bowls or buckets by their string from the neck of each bottle as shown below ● Ask learners - what do you think will happen when we pour water in each of these bottles? What do you think will come out? Learners write their guesses down ● Pour water from a container into each bottle and watch what comes out into the little buckets. Write your observations in your notebook and compare them to your guesses. ● You will notice that the water from the first bottle is filled with soil, while that from the one with leaves has very little soil, and the one with plants is clear! ● Why do you think this happened? This is because plant roots hold and protect the soil from erosion. Do you see how the roots are entangled in the soil when you lift the plant up? When desertification happens, soil erosion happens at a very fast rate because plants are not there to protect it! 

	20 minutes	Source: https://www.youtube.com/watch?v=im4HVXMGI68 Note: Learners can simplify this activity by placing a potted plant or rooted plant with soil in a container temporarily and poking a hole in the container. They can then pour water through the container to see how clear water comes out, which indicates that roots hold the soil together and do not allow water to wash it away. They will compare this with a container that has only soil and notice how a lot of the soil comes out with the water, which is similar to how soil erosion through rainfall occurs. The learner will draw a before and after image of a forest where desertification has occurred. He or she will also write a paragraph about what should be done to reverse the damage to this area. For example, planting more trees. Learners will share what they think should be done to reverse the damage due to desertification with family members/class for feedback and additional input
5	40 minutes	Learners will learn about how plant cells absorb water through osmosis and explore the phenomenon of desertification through two cool experiments. Learners will conduct the following experiment to learn about the mechanism that allows plant roots to absorb water from the soil – **osmosis**. Definition: **Osmosis** is the movement of water from a region of high concentration to a region of low concentration through a semipermeable membrane (surface or material that is somewhat porous, but not totally porous). Keep in mind that “high water concentration” refers to how much of the liquid is pure water. Saltwater has lower concentration of water compared to pure/distilled water because some part of it is salt and the other is water. The outer layer of potato pieces will serve as our semi-permeable membrane ● Peel and cut a potato into 8 strips of identical size and weight almost the size of French fries (6 cm long). Measure them using a ruler to make sure they are all the same length and width. ● Prepare 4 solutions: i) a bowl with water with no salt; ii) using one gram of salt (1/4th of a teaspoon) and 100 ml of water (1 tablespoon short of half a cup); iii) 3 grams of salt for 100 ml of water and iv) 5 grams of salt for 100 ml of water (if learners do not have the ability to measure, they can just prepare one cup of water with a tiny pinch of salt and the second will have two pinches of salt and the third will have three pinches of salt) ● Place two potato strips into each solution and two in a container with just water ● Let the potato strips sit for 20-30 minutes. What do you think will happen? Write down your hypothesis. ● Create the following table to record your observations:

Salt concentration	Initial length	Final length	Difference	% change
0 grams	6 cm			
1 gram	6 cm			
3 grams	6 cm			
5 grams	6 cm			

- Expected result: water moves from a place of high concentration to one with lower water concentration. Therefore, you can expect to find that in solutions with low salt concentration (and therefore higher water concentration), there is more water OUTSIDE of the potato, so water will move inside the potato by osmosis and increase the size of the strips, which will swell up. In solutions with high salt concentration and less water concentration, the opposite is true. There is more water INSIDE the potato than in the salt solution outside of it (because some of the saltwater molecules are occupied by salt – it is not pure water), so water will move out of the potato, resulting in the shrinking of the size of the strips.
- To calculate the percentage change:
  $\frac{\text{(final length - initial length)}}{\text{initial length}} * 100$

10 minutes

Learners will finally design their own plant! They can create a typical plant like a flower or design their own imaginary plant with special characteristics! Learners will think of the following:

- A creative name for their plant
- How the plant eats
- Whether the plant has a flower or just leaves
- The colors of each part
- The kind of environment or country the plant grows in

20-30 minutes

Learners will then either draw and color the plant or create 3D models such as the following. Learners will label the model and write a paragraph about each part of the plant describing its function in details:

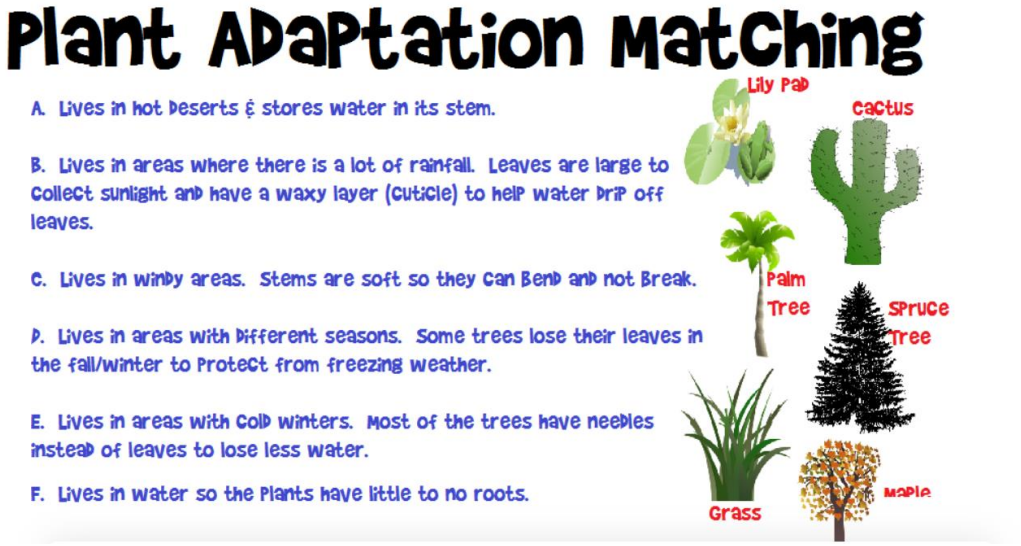
	30 minutes	Source: https://www.pinterest.com/pin/348395721166351529/ Optional: did you know that some of the fruits and vegetables we eat come from different parts of plant? Potatoes are actually the roots and grow under the ground! Learners can create an edible flower model with the help of an adult to show we eat different parts of plants. Learners will look in their kitchen for examples of vegetables and fruits that come from different parts of plants or they can purchase some of these next time they go grocery shopping. Suggestions: ● Flower: broccoli, cauliflower, artichoke, strawberries ● Stem: celery, asparagus, spring onions ● Leaves: spinach, lettuce, kale, Rocca/arugula ● Root: sweet potatoes, carrots, ginger, beetroot The learner will draw an outline of a flower and ask an adult to cut the vegetables and fruits into small parts so they can be placed on the outline as shown below. The learner may even include seeds such as pumpkin seeds, pistachios, walnuts, or cashew nuts:  Source : https://www.pinterest.com/pin/272327727265997O1/
	10 minutes	Learners will ~~share~~ present their model(s) with their families and quiz them on plant facts! Family feedback will include: - What they loved about the plant model? - What could be improved? - Any other suggestions for improvement Learners will use the feedback to revise their plant model
Assessment Criteria:		- Perseverance, critical thinking and precision in conducting experiments - Accurately labeled plant parts figure - Accurate and creative photosynthesis diagram

	- Accurately labeled plant life cycle figure - Creatively think of the uses of plant uses in daily life - Creative and labeled 3D or 2D plant model

Additional enrichment activities:	- Learners can observe the cycle of reproduction of flowering plants by cutting open a selection of fruits and examining the seeds. They can also plant seeds and observe their germination and growth. - Learners can calculate the average change in size from the potato strip osmosis experiment and present it in a graph. They can take the average of the two strips per container. - Learners can write a paragraph about what will happen if they drank a gallon of seawater or saltwater using their knowledge of osmosis.
Modifications for simplification	Learners can focus on writing one essay containing a labeled figure of plant parts, the functions of all these parts and some different uses humans have for plants.

APPENDIX

Source: https://sites.google.com/site/plantadaptations2ndgrade/



Source: https://www.thinglink.com/scene/730790365904240642