BIG BANG SCIENCE®

6+

PLANT GROWING

Botany experiments

EXPLORE THE WORLD OF BOTANY

Observe plant world

Discover the secret of roots

STEAM EXPERIMENT KIT

SCIENCE | OPERATION ABILITY | SENSORY

INCLUSIVE **HYDROPONIC PLANTS**

WARNING:
CHOKING HAZARD - THIS TOY CONTAINS SMALL PARTS . NOT FOR CHILDREN UNDER 3 YEARS.

CAN MAKE **19** ACTIVITIES

ACTIVITY GUIDE

BOTANY SCIENCE EXPERIMENTS

PLANT GROWING

There is a kind of expressionless and speechless creatures in the nature, but their vitality is so strong. Such creatures are called plants, nature gives them the power to grow, and they will feedback to nature through their own contributions. Let's explore the mystery of plants together.

NOTE TO PARENTS

These activities can be played many times. The children will need your assistance and supervision. Enjoy this time together, you are encouraging your children to explore the scientific world with inquiry and passion. This might be a lifetime memorable experience.

What's included in the kit:

What you need to get or use:

Glue, Water, Cutter, Refrigerator, Corn Seeds, Soybean Seeds, Grass Seeds, Flower Seeds, Scissors, Food Coloring or Ink, Branches of Plants, White Flower, Leaves, Vegetable Oil, Soil, Blank Paper, Drinking Straws, Dish, Tape, Drinking Cup, Drinking Water, Socks, Ruler.

Activity #1: Where Are The Seeds?

Do you know where the seeds of the plant are? Sometimes they are served as food on the table, and sometimes they will travel with you. Let's go and find the seeds of plants.

What's included in the kit: Magnifier and Pencil.

1. Let's go and find the variety of seeds together and observe their shapes.

2. Draw the shapes of the seeds below, and record their names and places of discovery.

3. Autumn is the season of harvest. If you put on your woolen socks or velveteen pants and have a walk in the grass, there may be many unexpected harvest.

4. The seeds of corns and soybeans may be seen in the kitchen or supermarket. Seeds of flowers and grasses, you can find them in the backyard or garden.

Shape	Name	From
		
		

Fun Fact

1. The seeds of legumes are usually stored in pods (like peanuts, peas, etc).
2. Fruit seeds are protected by the thick pulp (like apples, pears, etc).
3. Some plants' seeds are often regarded as the food of human beings (like soybean, wheat, corn etc).
4. XanThium seeds can travel by sticking to our clothes or animals' fur. dandelion seeds drift with winds before finally taking root.

More Challenges: The Art of Seeds

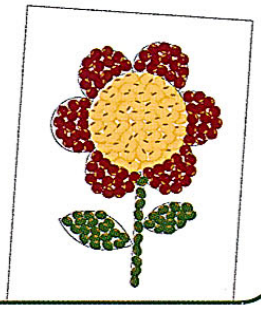
What's included in the kit: Tweezers and Pencil.

What you need to get or use: Glue, Blank Paper, Variety of Seeds (mung bean, black bean, azuki bean, sunflower seed, pumpkin seed, etc).

1. Draw a picture and think about the colors that needs to be filled.

2. Choose the seeds with the suitable color and size, paste the seeds on the picture after applying the glue.

3. Fill the picture with different seeds to complete the artistic creation.

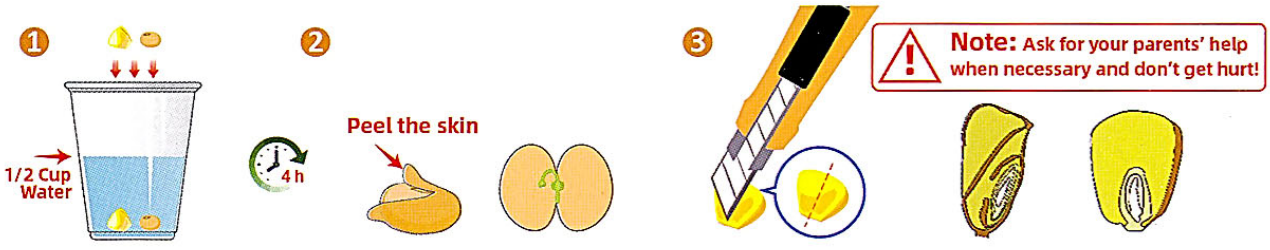


Activity #2: What Does the Inside of The Seed Look Like?

What's included in the kit: Cup and Magnifier.

What you need to get or use:

Some Corn Seeds, Some Soybean Seeds, Some Water and Cutter.

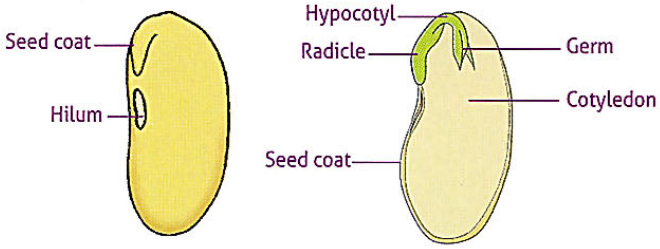


1. Pour the water into the Cup until half full, and soak soybean seeds and corns seeds in water for about 2 to 4 hours until they become soft.

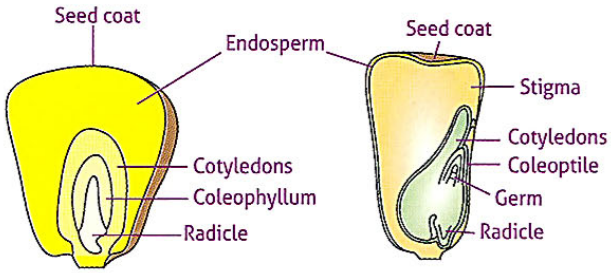
2. Peel the skin of soybean seeds, cut the seeds into two halves and observe the structure inside.

3. Cut a corn seed along its middle into halves and observe the structure inside.

Soybean Seed



Corn Seed



4. Compare the differences between soybean seeds and corn seeds, find the internal structure of the seed and the corresponding part of the picture.

Science Behind the Experiment

Flowering plants, or angiosperms, fall into two classes, based on the number of cotyledons, or seed leaves, within their seeds. For monocotyledons, also called monocots, seeds contain only one cotyledon. In contrast, dicotyledons or dicots hold two cotyledons in their seeds. These cotyledons are the first leaves of a seedling and serve to absorb nutrients in the endosperm, or food storage of the seed. They are not used for photosynthesis.

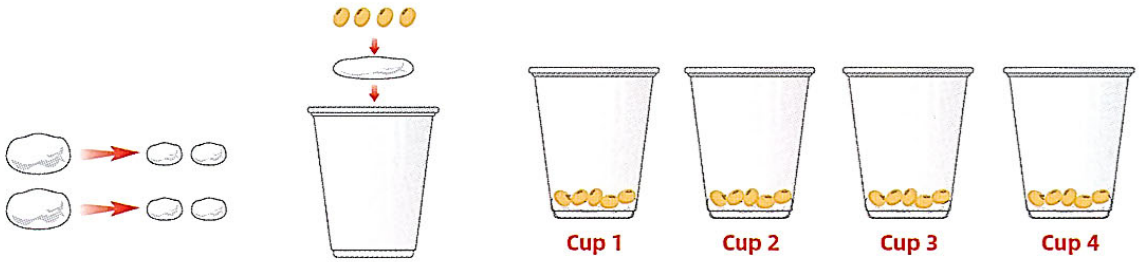
Activity #3: How Do Plants Sprout?

Why are seeds stored in a barn unable to germinate but those planted in soil can? What makes seeds asleep germinate and grow? Try the following activity.

What's included in the kit: Cup and Cotton Ball.

What you need to get or use:

Some Soybean Seeds, Some Water and Refrigerator.



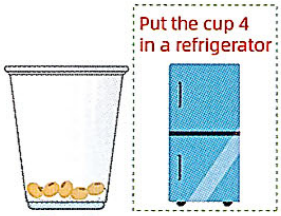
1. Tear 2 cotton balls into 4 pieces and lay each piece at the bottom of the 4 cups respectively. Put 4 to 5 soybean seeds into each of the cup.

2. Put cup 1 in a warm place with nothing added.

Note: Add a little water into cup 2 each day to keep the cotton wet.

3. Add some water into cup 2 to wet the cotton ball piece(please make sure the water level dose not exceed the soybean seeds), and put the cup in a warm place.

4. Pour the water into the Cup 3 until half full, with the soybean seeds at the bottom and put it in a warm place.



5. Add some water into cup 4 to wet the cotton, and put the cup in the refrigerator.

6. Record the environment around each cup, Wait for about one week, and check in which cup the soybean seeds germinate?

	1 Day	2 Days	3 Days	4 Days	5 Days	6 Days	7 Days
Cup 1							
Cup 2							
Cup 3							
Cup 4							

7. Only the soybean seeds in cup 2 germinate.

Science Behind the Experiment

The three conditions of seeds germination: that is sufficient water and air as well as proper temperature

Fun Fact

Seeds also have a lifespan. Willow seeds only live for 12 hours wheat seeds and rice seeds 3 years, while lotus seeds, the most long-live seeds in the world, could live for 830 to 1250 years.

Activity #4: Swollen Bean

Have you ever seen grass growing from under a heap of rubble or rocks? Where does its strength come from?

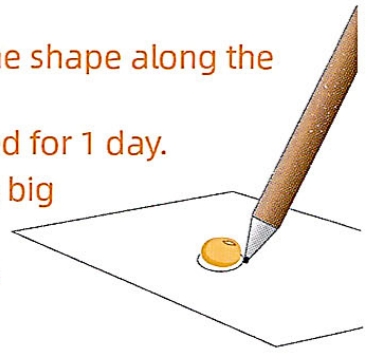
What's included in the kit: Cup and Pencil.

What you need to get or use: Water and Soybean Seed.

1. Put the soybean seed in the small circle below and portray the shape along the edge of the soybean seed.

2. Pour 1/2 cup of water into the cup and soak the soybean seed for 1 day.

3. Take the soybean seed out and wipe it dry and place it in the big circle below, and portray the edge shape of the soybean seed again to compare whether the soybean seed has grown larger.



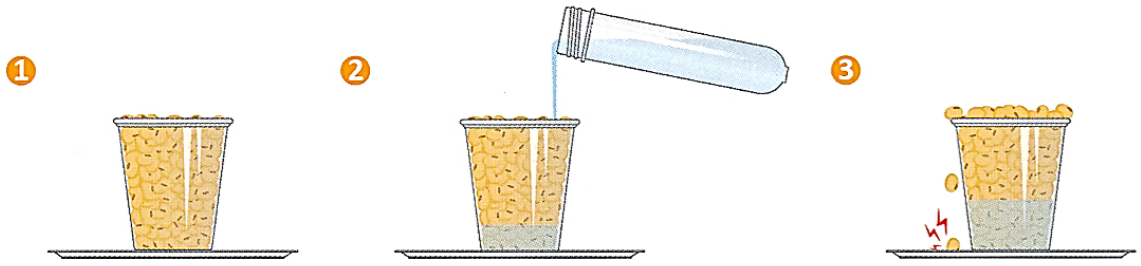
Science Behind the Experiment

Seed germination begins with a seed absorbing water, which leads to swelling and a softening of a seed's coat or testa, activating the metabolic functions needed for germination and growth. After absorbing enough water, the embryo grows too large for the seed and bursts the outer shell, a small plant emerges.

More Challenges: Horrible Beans

What's included in the kit: Cup and Test Tube.

What you need to get or use: Water, Dish and Soybean Seeds.



1. Fill the cup with soybean seeds and place it on a plate.

2. Add 1 test tube of water, as time goes on, the soybean seeds will fall from the cup and hit the plate with a clanging sound.

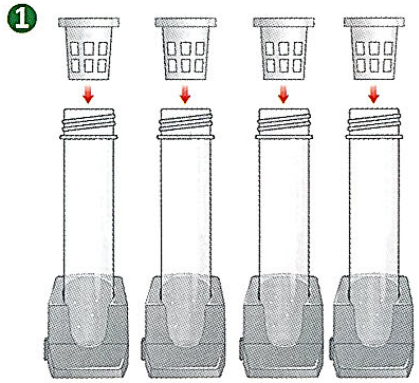
3. Doing this prank at night, the inexplicable clanging noise in the quiet room makes people feel creepy.

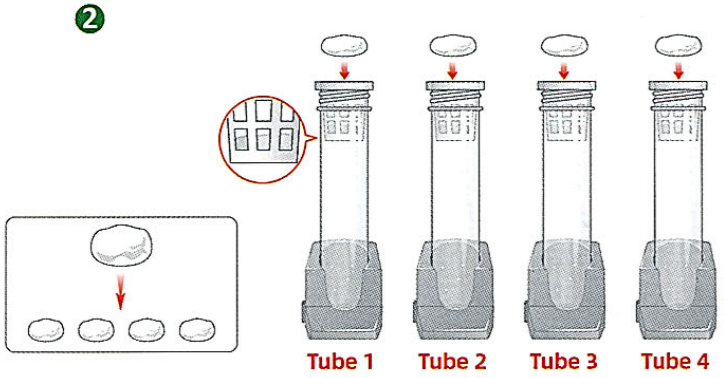
Activity #5: The Beginning of Plant Life

The birth of a life is the magic of nature. Germination is the beginning of a plant life. Experience the surprise brought by the beginning of a life!

What's included in the kit: Test Tube, Test Tube Stands, Hydroponic Basket and Cotton Ball.

What you need to get or use: Soybean Seeds, Water, Corn Seeds, Grass Seeds, Flower Seeds and Ruler.

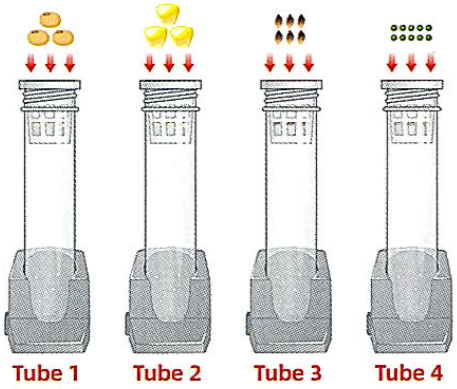




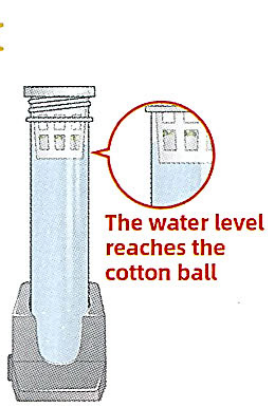
1. Put the 4 test tubes on the Test Tube stands, and put a hydroponic basket into each of them.

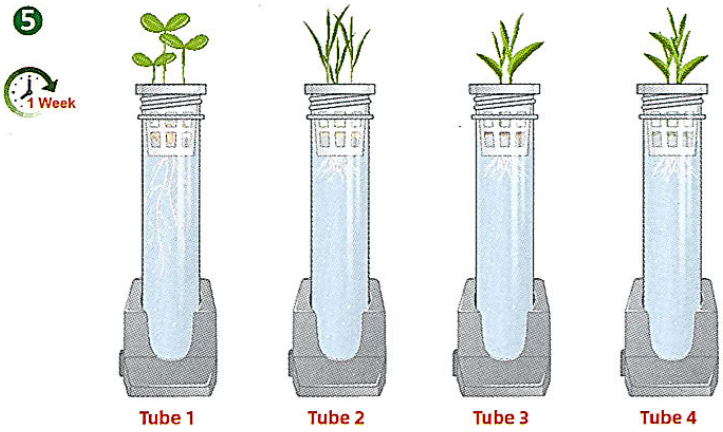
2. Tear the cotton ball up into pieces and put a little cotton into each of the hydroponic baskets.

3. Put 2-3 soybean seeds into one hydroponic basket. Put 2-3 corn seeds into the other hydroponic basket. Put 5-6 grass seeds into the third hydroponic basket. Put about 10 flower seeds into the fourth hydroponic basket.



Note: If you can't find corresponding seeds, you can put other types of seeds into the hydroponic baskets, but make sure not too many.





4. Add water into the test tubes until the water level reaches the cotton ball pieces but does not exceed the seeds. Put the test tubes in a warm place and wait for the germination of the seeds. Check the declining of the water level every day, keep the cotton soaked.

5. After about a week, the seeds will germinate. Record the process of seed planting, sprouting and plant growth.

Fun Fact

Seeds that are just mature won't germinate right away, and this period is called a period of dormancy, which can help a seed travel farther and germinate and grow in the best environment and prevent the death of plants due to germinating before the winter.

RECORDS OF PLANT GROWTH

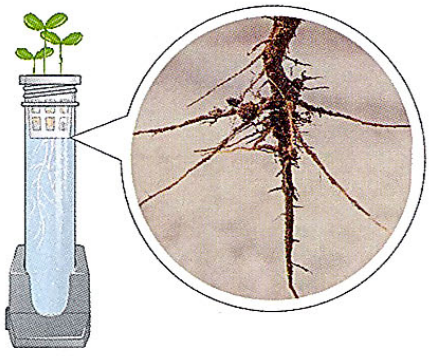
Planting Time	Growth Height				Roots Length			
	Tube 1	Tube 2	Tube 3	Tube 4	Tube 1	Tube 2	Tube 3	Tube 4

Activity #6: They Grow Differently

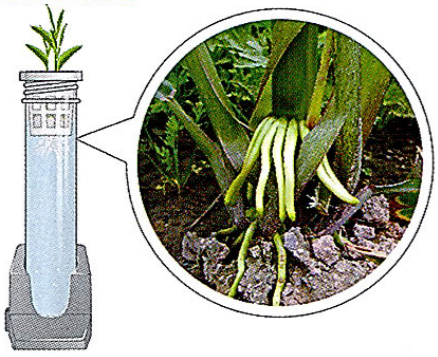
After a week, the planted plants have sprouted. Let's observe these young lives.

What's included in the kit: Plants used in Activity#5 and Magnifier.

Soybean Seed



Corn Seed



1. After all the plants sprout, take a look at the difference between corn seeds and soybean seeds.

2. After the sprouting of corn seeds, the leaves directly drill out of the corn seeds, gradually grow upward, and the leaves become more and more.

3. After the sprouting of soybean seed, the two halves of a bean expand, a long stem grows from the middle, finally the opposite leaves grow.

Science Behind the Experiment

Difference Between Dicotyledons and Monocotyledons:

Bud: Monocots have only one seed leaf, Dicots have two seed leaves.

Stem: The vascular bundles of a monocotyledon are scattered, while those of a dicotyledon are arranged in a ring.

Root: Roots of a monocot are adventitious with the main root worse developed, roots of a dicot are radicle with the main root well developed.

Leaf: The leaf veins of a monocot are parallel, while those of a dicot are reticulate.

Activity #7: Their Roots Are Different

Root is an important organ of a plant which delivers the absorbed water and inorganic salt from the soil and organic phosphorus, amino acid and other organic substances synthesized by itself to the above ground part of the plant continuously. It plays an important role in the whole nutrition system of the plant.

❶

What's included in the kit:

Plants Used in Activity#6 , Magnifier and Ruler Sticker.

What you need to get or use: Scissors.

1. As the plant sprouts, the root of the plant will extend from the seed and grow downward. Observe the shape of a root system. Which plant has more roots? What kind of root is more thick?

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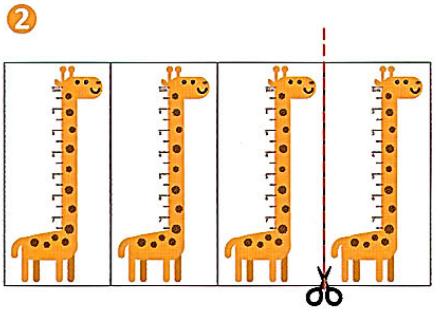
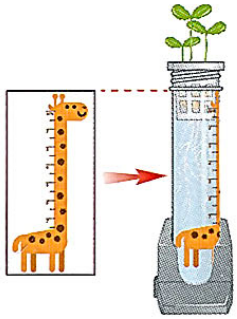




2. Separate the ruler sticker with the scissors. Stick the ruler to each test tube, keeping the ruler upper end at the ring part of the test tube.

3. Record the daily growth and the weekly length increase in the table on the right.

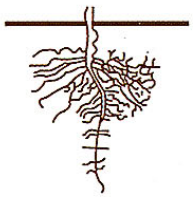
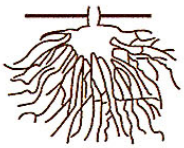
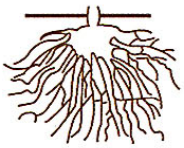
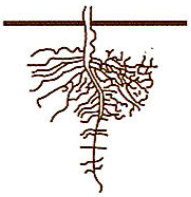
Science Behind the Experiment: Root System Classification

Tap Root System:

1. There is typically a radical which can be easily distinguished from The main root is obviously well developed and growing the lateral roots, which can be easily distinguished.
2. The tap root system reaches down quite deep and absorbs water and inorganic salts from the soil.

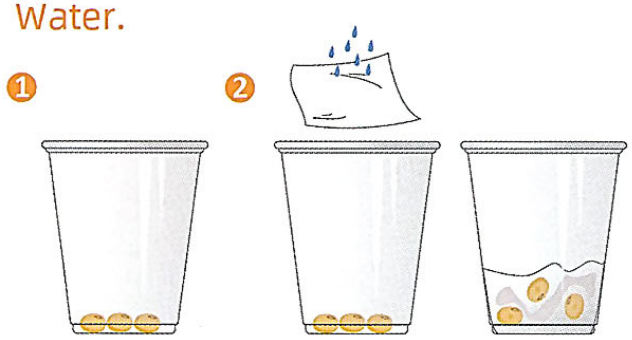
Fibrous Root System:

1. After the seed germination, the main root degenerates rapidly, and similar tufted fibrous roots grow from the lower part of the stem.
2. Fibrous root reach not so deep in earth and absorbs water and inorganic salts from the shallow soil.

	Soybean (Tube 1)	Corn (Tube 2)	Grass (Tube 3)	Flower (Tube 4)
The leaf type				
The root type				
1 day				
2 days				
3 days				
A week				

More Challenges: Down-growing Root

What you need to get or use: Cup.
What you need to get or use: Blank Paper, Soybean Seeds and Water.



1. Put 3 soybean seeds into the cup.
2. Wet the blank paper and put it into the cup, press the seeds on the wall of the cup.

Note: Keep the blank paper in the clear cup moist throughout the entire activity.

3. Knead another piece of blank paper into a spitball and stuff it into the cup.
4. Put the cup upside down on the table to let the soybean seeds sprout and grow.
5. After a few days, the roots of the plant will protrude from the soybean seeds and grow downward.
6. Turn the cup upside down so that the roots face upwards. After a few days, the roots of the plant begin to grow downward again.

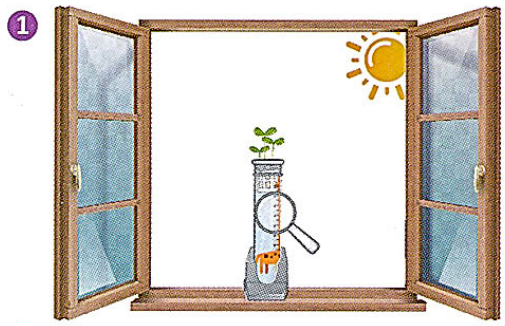
Science Behind the Experiment

The gravity of the earth can change the distribution of auxin concentration in plant roots, causing plant roots to grow downward.

Activity #8: "Little Root Hair" Plays An Important Role

The roots of plants are like strands of long beards, and some tiny tomentums are attached to these "beards", which can absorb a lot of nutrients for the plants. Use a magnifier to observe the mystery.

What's included in the kit: Plants used in Activity#7 and Magnifier.



1. Put the test tubes with the plants on a window exposed to sunshine. (or you may try to cast light to the plants' root systems with a lamp).
2. With the help of the light outside the window, what will be discovered by observing the root system of plant?
3. There are many tiny tomentums on each root system, which is the unique root hair of plant root system.

Science Behind the Experiment

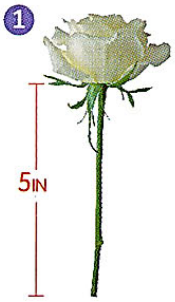
At the roots, you will find that there are many tiny hairs. The root hairs increase the absorption area and secrete various substances that facilitate dissolution of minerals into nutrients easier to be absorbed.

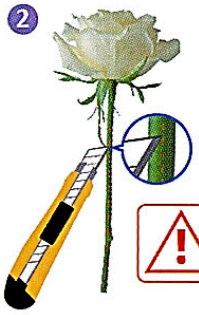
Activity #9: Coloring Flower

Have you seen flowers with mixed colors? Now you can plant a colorful flower for you with your hands.

What's included in the kit: Cup.

What you need to get or use: Food Coloring or Ink, Water, White Flower and Cutter.

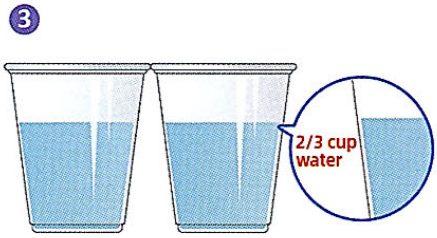


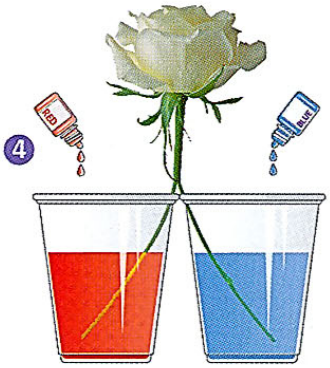


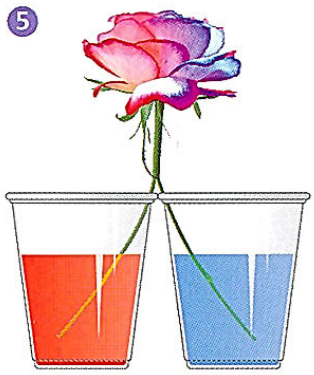
1. Find a white flower and make sure that its branche below the flower is 5 inches.
2. Cut down from the middle of the branch.

Note: Ask for your parents' help when necessary and don't get hurt!

3. Fill two cups with 2/3 cup of water respectively.
4. Add red coloring to one cup, and blue coloring to the other cup.







5. Put the separated branches in two cups and let them stand still for 4-5 hours.One side of the flower turns red, and the other side turns blue.

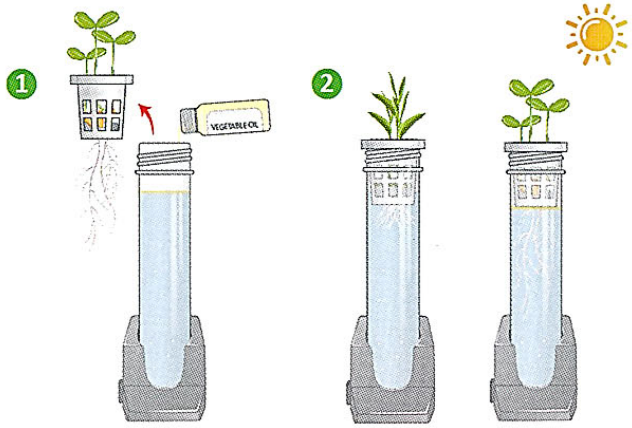
Science Behind the Experiment

Plants transport water and nutrients through the vessels in the rhizomes. When the branches of the plant absorb the red and blue solutions at the same time, the flowers are dyed in two colors.

Activity #10: Transpiration

Water in lakes, oceans, and rivers evaporates and forms clouds that eventually causes rainfalls. And plants also return the water absorbed to the nature through its parts.

What's included in the kit: Plants used in Activity#8.
What you need to get or use: Vegetable Oil.



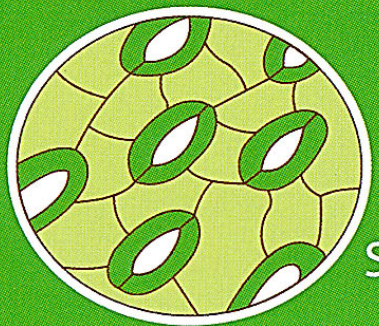
1. Pour vegetable oil into a test tube, which just blocks the water.

2. Place the plants in the sunshine and record the height of the water surface falling for 1-3 hours.

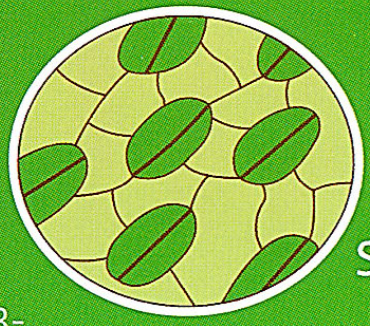
3. In the sunshine, vegetable oil prevents the evaporation of water, which is completely released into the air through the plants.

Science Behind the Experiment

Transpiration is the process by which moisture leaves the green plants through small openings in their leaves called stomata.Root hair present at the terminal ends of roots absorb moisture from surrounding soil and transport it to the leaves through the stem. Leaves release this absorbed moisture into the atmosphere by transpiration.Plants supply a large amount of the world's water. About 10 percent of all water enters the global water cycle via plant transpiration.



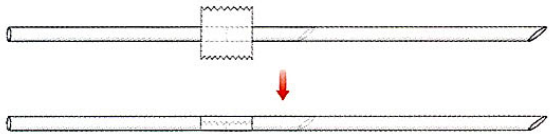
Stoma open



Stoma close

More Challenges: How do plants drink water

What you need to get or use: Drinking Cup, Drinking Water, Drinking Straws and Tape

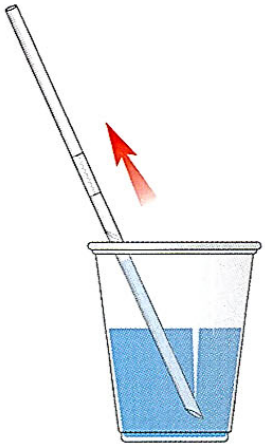


1. Connect two drinking straws and tape them together.

2. Insert a straw into the drinking cup with drinking water, it is easy to absorb the water into the mouth, and the vessels in the plant will also transport water.

3. Try to connect more straws. As the length of the straw increases, it will become more difficult to absorb water.

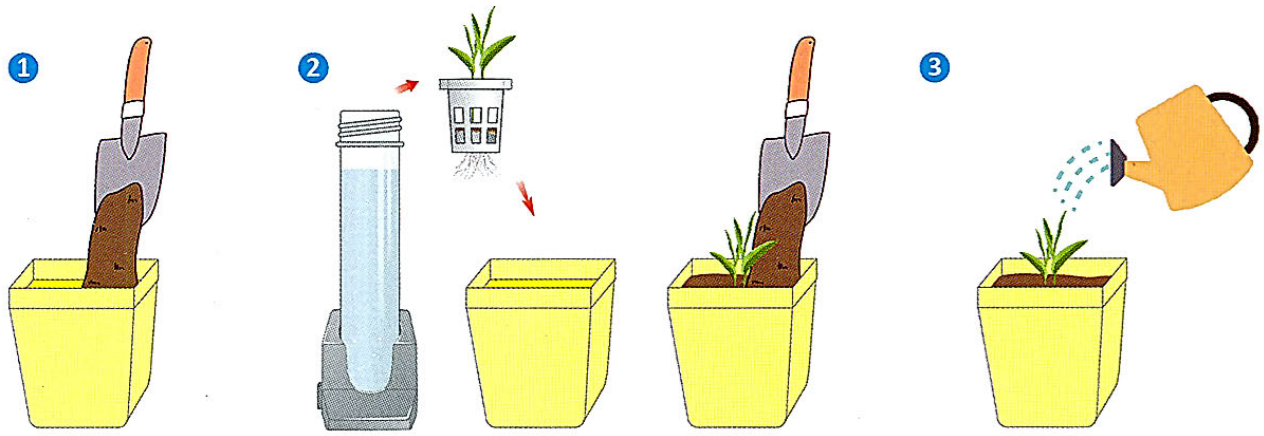
4. Is it difficult for branches and leaves to absorb water? Plants rely on transpiration to transport water to farther leaves.



Activity #11: Plants Need More Nutrients

Although seeds can germinate and grow in the test tubes, but water can not provide enough nutrients for growth. Transplant the plants and provide them enough nutrition.

What's included in the kit: Plants used in Activity#8 and flowerpot.
What you need to get or use: Soil.



1. Fill the flowerpot with a small amount of soil.

2. Put the plants in the test tube and the hydroponic basket into the flowerpot. Continue to add soil to bury plant roots.

3. Water the plant after planting to keep the plant growing.

Science Behind the Experiment

There are few nutrients in the water. After germination, a plant uses up nutrients stored in the seed, and its growth slows down, so it is necessary to replant it into the soil.

Activity #12: Plants Like Sunshine

The sun is the main source of energy for plants, and the crown is often denser on the sunny side. Will plants like the sun? Let's verify your guess together.

What's included in the kit: Plants used in Activity#11.
What you need to get or use: Water.

1. Put plants on the windowsill and don't move them randomly. After 3-4 days, the plants bend and grow toward the window.

2. If you can see sunflowers outdoors, you will find that the sunflower's flowers always turn to the sun.

Science Behind the Experiment

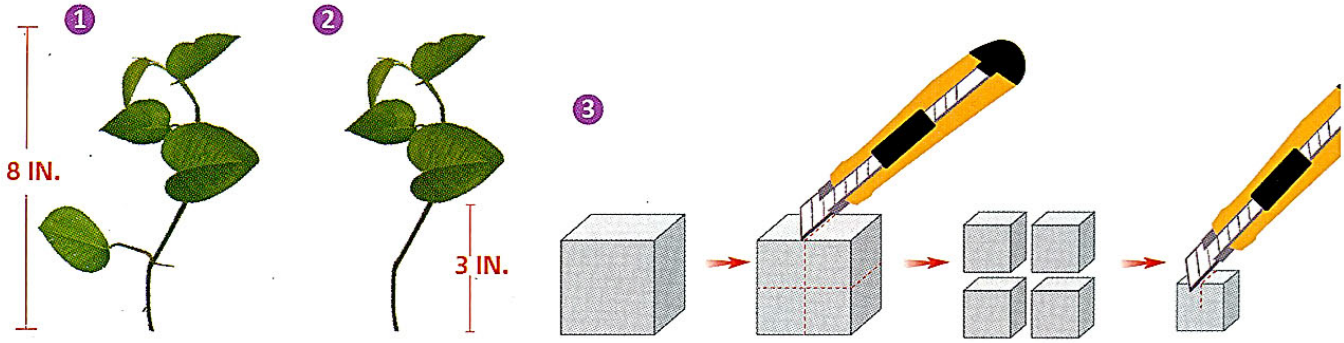
Why do plants grow in the direction of sunlight?
It's because the top of the plant's buds secrete auxin, the auxin will move to the backlit side to promote the growth of the backlit surface, thereby make the plant bend to the light source.

Activity #13: Strange Porting

Not all plants rely on seeds to propagate, take a look at another ability of plants.

What's included in the kit: Sponge and Cup.
What you need to get or use: Water, Branche of Plant and Scissors.

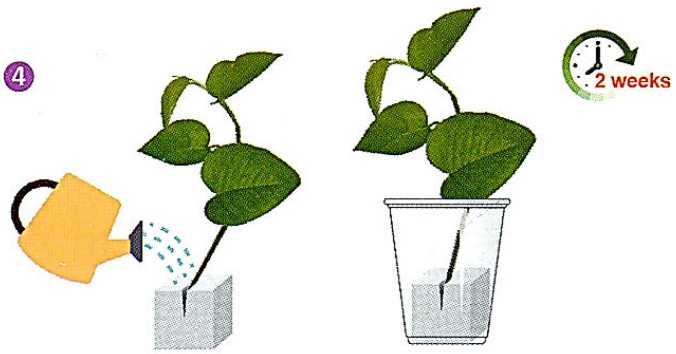
Not all plants are suitable for cuttage. Try snake plant, jasmine, chlorophytum comosum, lavender, rose, rosa chinensis, epipremnum aureum. Watch out for thorns!



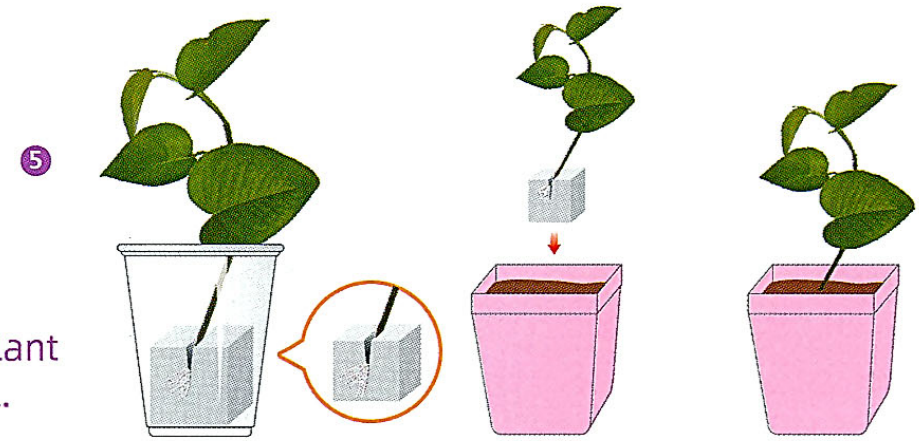
1. Cut out branche with a length of 8 inches to ensure that the cut surface is smooth.

2. Remove the leaves 3 inches from the lower end of the branch, and keep the upper leaves to avoid excessive evaporation of water.

3. The sponge is equally divided into four pieces, and each piece of sponge is cut along its 1/2 position.



4. Put the branche into the gap of the sponge and place it in a cup after being wet. Plant is placed in a cool and ventilated place, keep the sponge moist, root will grow out in about 1-2 weeks.



5. The root system grows to 2-3 cm, plant the plant in the soil.

Science Behind the Experiment

Plant propagation mainly includes the following types:

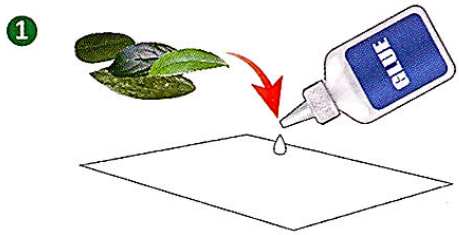
Spore propagation: the plant propagates by releasing spores. Such as algaes and ferns.

Seed propagation: the plant produces seeds by flowering for propagation. Such as angiosperms and gymnosperms.

Vegetative propagation:direct propagation of certain parts of the plant itself. Such as potatoes, garlics, etc.

Activity #14: The Art of Plants

What's included in the kit: Wiggly Eyes.
What you need to get or use: Leaves, Glue and Blank Paper.

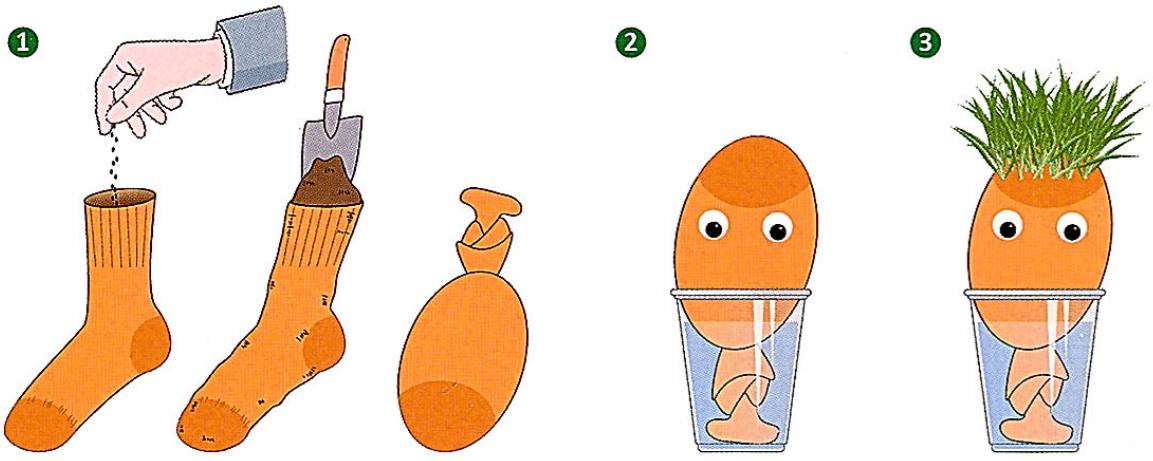


1. Find some different leaves and try to use the leaves to make some patterns, such as boats, small animals, etc. Glue these leaves on blank paper to make a beautiful picture.

2. You can try to decorate the animals made of leaves with wiggly eyes.

More Challenges: Grass Doll

What you need to get or use: Wiggly Eyes and Cup.
What you need to get or use: Sock, Grass Seeds and Soil.



1. Sprinkle grass seeds in a sock, add soil and tie it tightly, then decorate it with wiggly eyes.

2. Put the sock in a cup and pour a small amount of water.

3. Keep the sock moisturized for about a week, the grass will grow out of the sock and become a doll with hair.

FUN FACT

There are about 320,000 species of plants, of which the great majority, some 260–290 thousand, produce seeds. Green plants provide a substantial proportion of the world's molecular oxygen, and are the basis of most of Earth's ecosystems. Plants that produce grain, fruit, and vegetables also form basic human foods and have been domesticated for millennia. Plants have many cultural and other uses, as ornaments, building materials, writing material and, in great variety, they have been the source of medicines and psychoactive drugs.

Trees are an important carbon sink. A single tree can absorb 48 pounds of carbon dioxide a year. It also filters the air by absorbing other pollutants. When the tree is gone, the carbon dioxide it would have used for photosynthesis either remains in the atmosphere or gets absorbed by the oceans, which are becoming increasingly acidified and less able to absorb more. Carbon dioxide is a greenhouse gas. It helps create a "ceiling" in the atmosphere that prevents ground heat from dissipating into space. In other words, deforestation leads directly to global warming, which is one of the most serious ecological issues facing modern humanity.