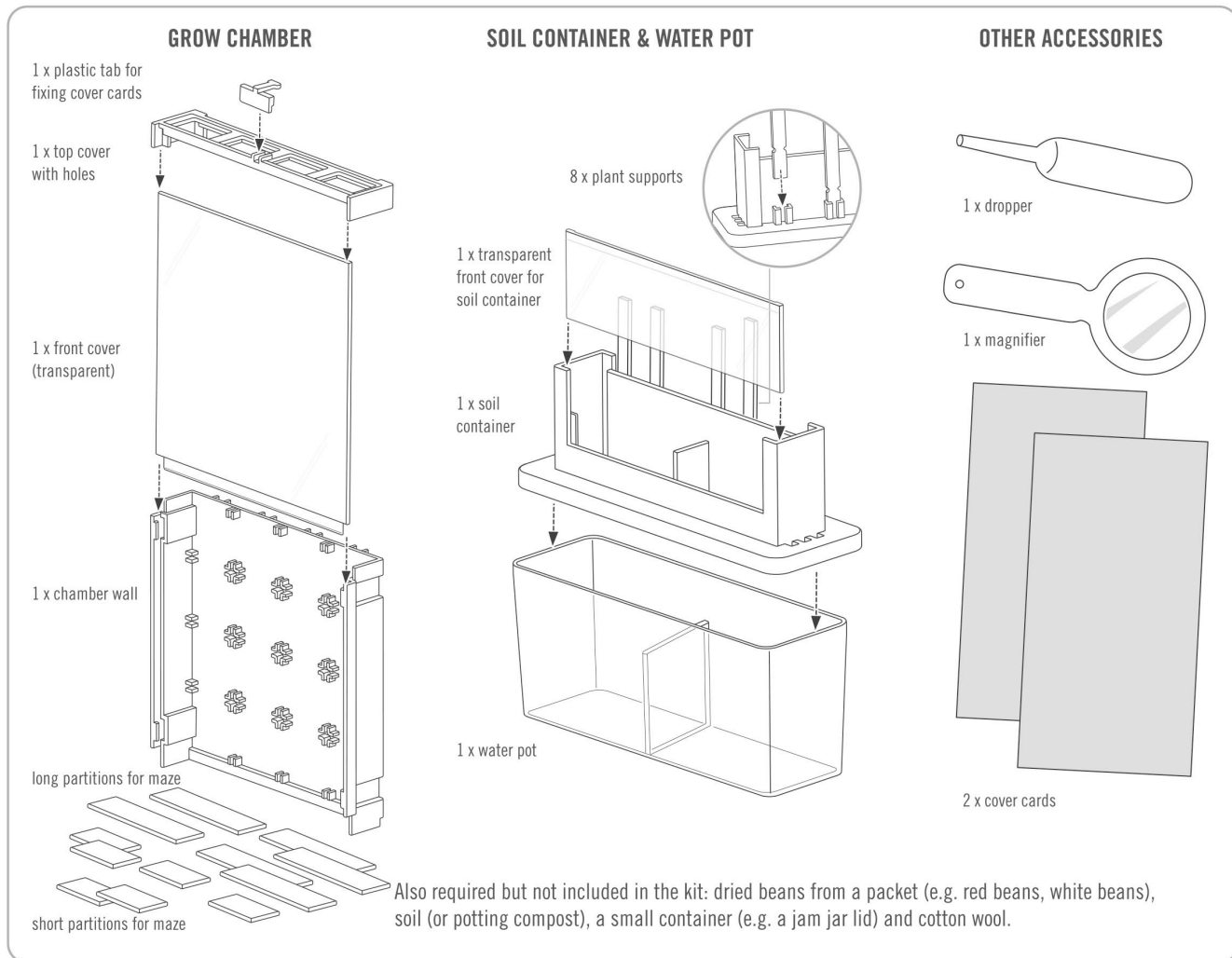


Grow-A-Maze

A. SAFETY MESSAGES

1. Read these instructions thoroughly before starting the experiments.
2. This kit and its finished product contain small parts which may cause choking if misused. Keep away from children under 3 years old.
3. This kit is intended for children aged over 8.



B. CONTENTS

The plant maze consists of three major structures, namely a grow chamber, a water pot, and a soil container. Components are as follows:

GROW CHAMBER

- 1 x plastic tab for fixing cover cards,
- 3 x long partitions for maze,
- 3 x short partitions for maze,
- 1 x top cover with holes,
- 1 x chamber wall,
- 1 x front cover (transparent).

SOIL CONTAINER & WATER POT

- 8 x plant supports,
- 1 x transparent front cover for soil container,
- 1 x soil container,
- 1 x water pot.

OTHER ACCESSORIES

- 1 x dropper,
- 1 x magnifier,
- 2 x cover cards.

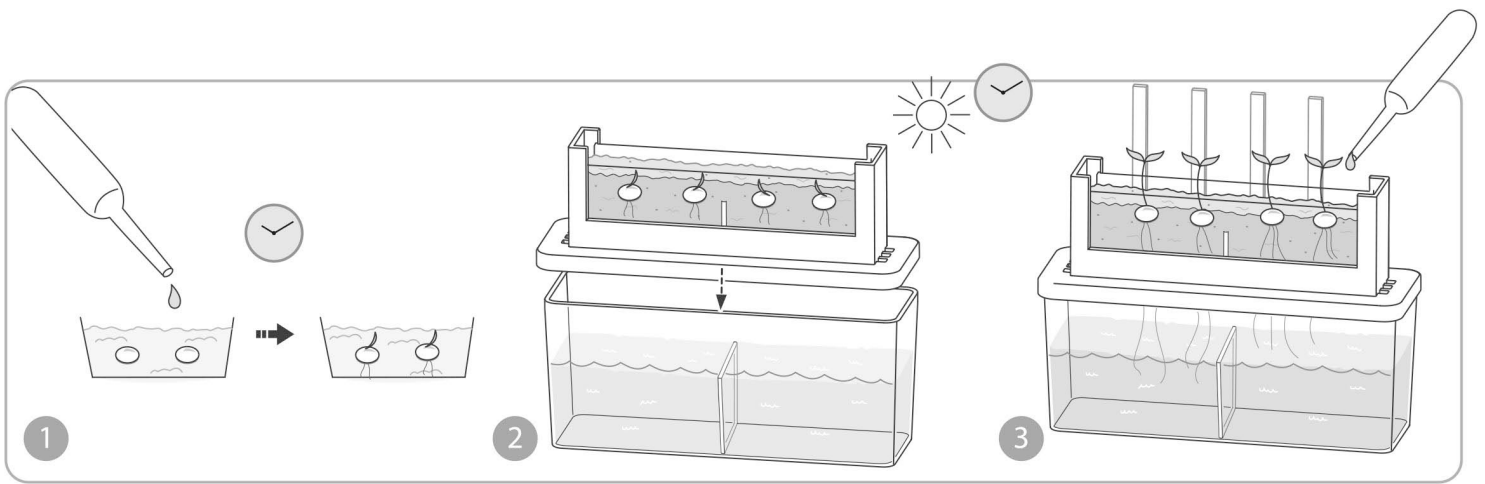
Also required but not included in the kit: dried beans from a packet (e.g. red beans, white beans), soil (or potting compost), a small container (e.g. a jam jar lid) and cotton wool.

C. EXPERIMENT 1: GROW AND WATCH

Watch the bean grow and observe its root develop. Learn the basic of plant science.

Materials: the water pot and the soil container.

Materials required from home : a small container (e.g. a jam jar lid), some beans and soil (or potting compost), cotton wool.



EXPERIMENT STEPS

1. First you need to germinate some beans (make them start growing). Cover the bottom of the small container with cotton wool, and pour on a little water to make the cotton wool damp. Gently press some beans into the cotton wool. Place the container somewhere warm, and keep the cotton wool damp. After a few days your beans will germinate (roots and shoots appear). Now you can transfer the beans to the soil container.
 2. Half fill the water pot with water. Place the soil container on top of the water pot, with the open side facing you. Slot the transparent cover into the slots in the front of the soil container. Fill the soil container with soil from the garden or with potting compost, and add a little water to moisten the soil or compost. Take some of your germinating beans and push them very gently into the soil. Don't worry about which way up they are. You can clip the plant supports into the back of the soil container to support the shoots as they grow. Or you can simply slot the grow chamber to the soil container to act as a support.
 3. Put the set upon a window sill, where the plants will get some light. Watch what happens over the next few days.
- What happens to the roots and the shoots growing from the seed? You should see that the shoots grow upwards and the roots grow downwards, through the soil and into the water.

HOW IT WORKS

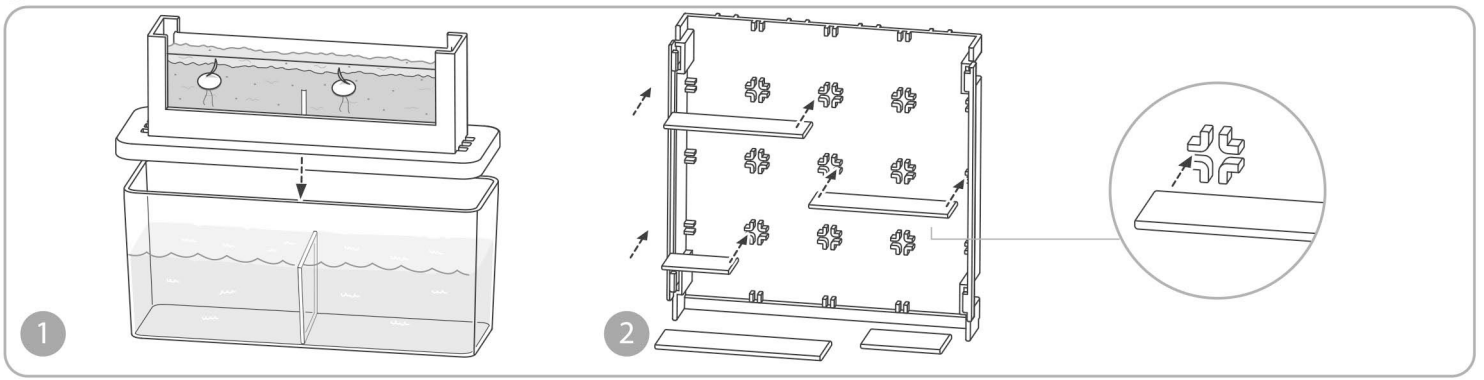
The roots grow down and the shoots grow up because of an effect called geotropism. This means the root and shoot detect the Earth's gravity. One side of a root or shoot grows more than the other side, so that they bend over.

FUN FACTS

- Beans are the seeds of plants. When they are placed in water, they begin to grow roots and shoots. This is called germination.
- The food the plants needs to germinate is stored in the bean.
- Roots always grow down. This called positive geotropism (because the roots grow towards the Earth).
- Shoots always grow upwards. This is called negative geotropism (because the shoots grow away from the Earth).
- If you turn a bean upside down, in a few hours the roots and shoots will grow in curves so they are pointing the right way again.
- Roots grow down because they anchor the plant in the soil, and search for water and nutrients in the soil.
- Shoots grow upwards to search for light and air.

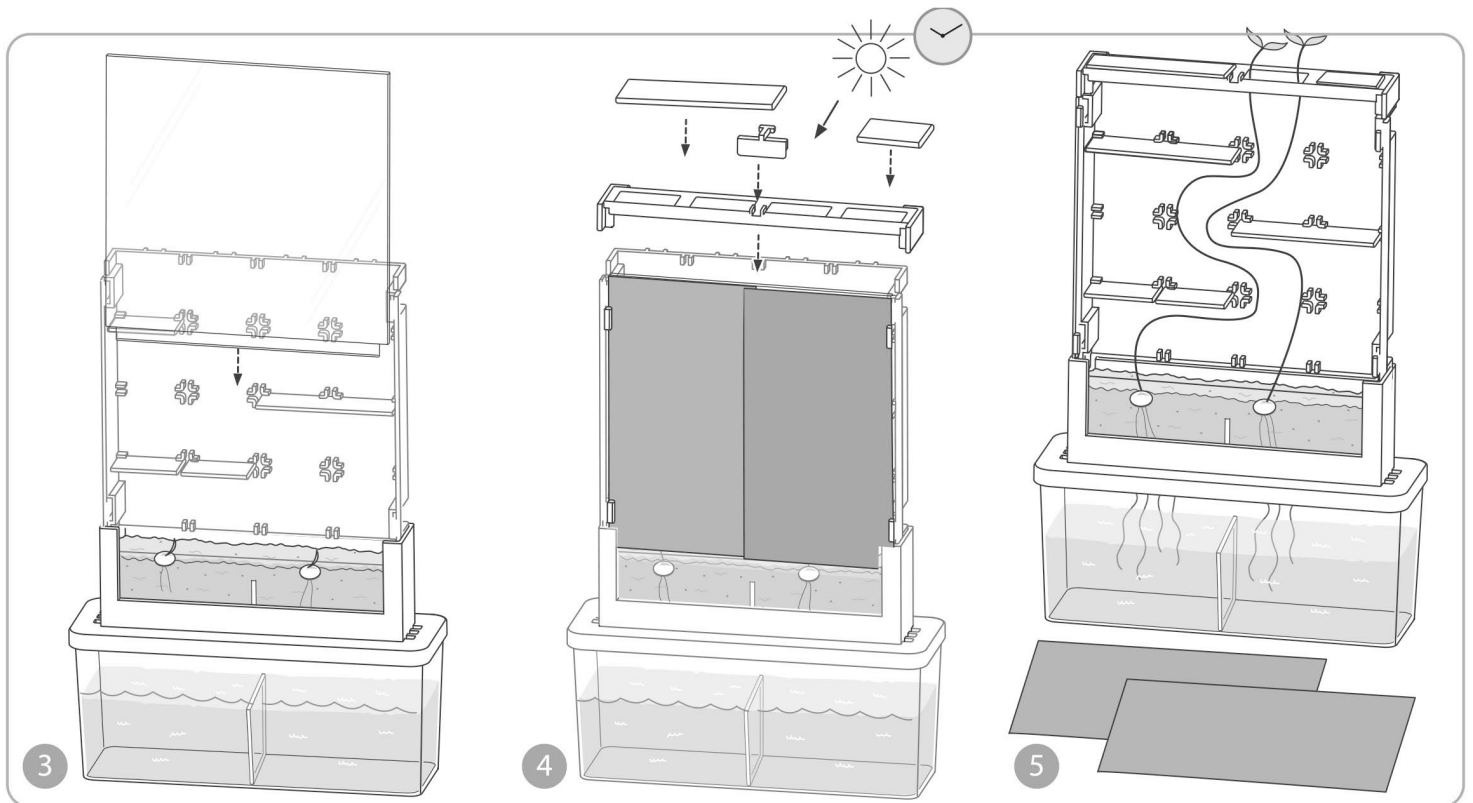
D. EXPERIMENT 2: PLANT MAZE

Observe how a plant grows and winds its way through a simple maze.



EXPERIMENT STEPS

1. Repeat sections 1 and 2 above. Germinate some beans and transplant two into the soil container, one each partition.
2. Now design your maze. Slot the long and short partitions into the chamber wall to make a maze for the plants to grow through from bottom to top. Make sure there is a way through the maze.



3. Slide the grow chamber's front cover into place (the lip at one end of the cover should slip behind the soil container cover). Slot the chamber's top cover onto the top of the soil container.
4. Put the cover cards over the front, and add the plastic tab to keep the card in place. Make sure the two cards are overlapped so that no light will leak through into the chamber. Cover three of the holes in the top cover with the spare partitions, so that light can only get in through one hole (the uncovered hole will be the 'exit' from the maze).
5. Watch the plants as they grow over the next few days. Temporarily take off the card cover to see what's happening inside the maze. Make sure you put it back in place afterwards, and that it blocks light from entering the maze. Did your plants find their way through your maze?

HOW IT WORKS

Plants always seek out light, because they need light to keep growing. Light enters the maze through the top, and a little light bounces down through the maze. The plants grow towards this light. This effect is called phototropism. When light shines from one side of a shoot, the shoot grows more on that side, which makes the shoot bend towards the light.

TROUBLE SHOOTING

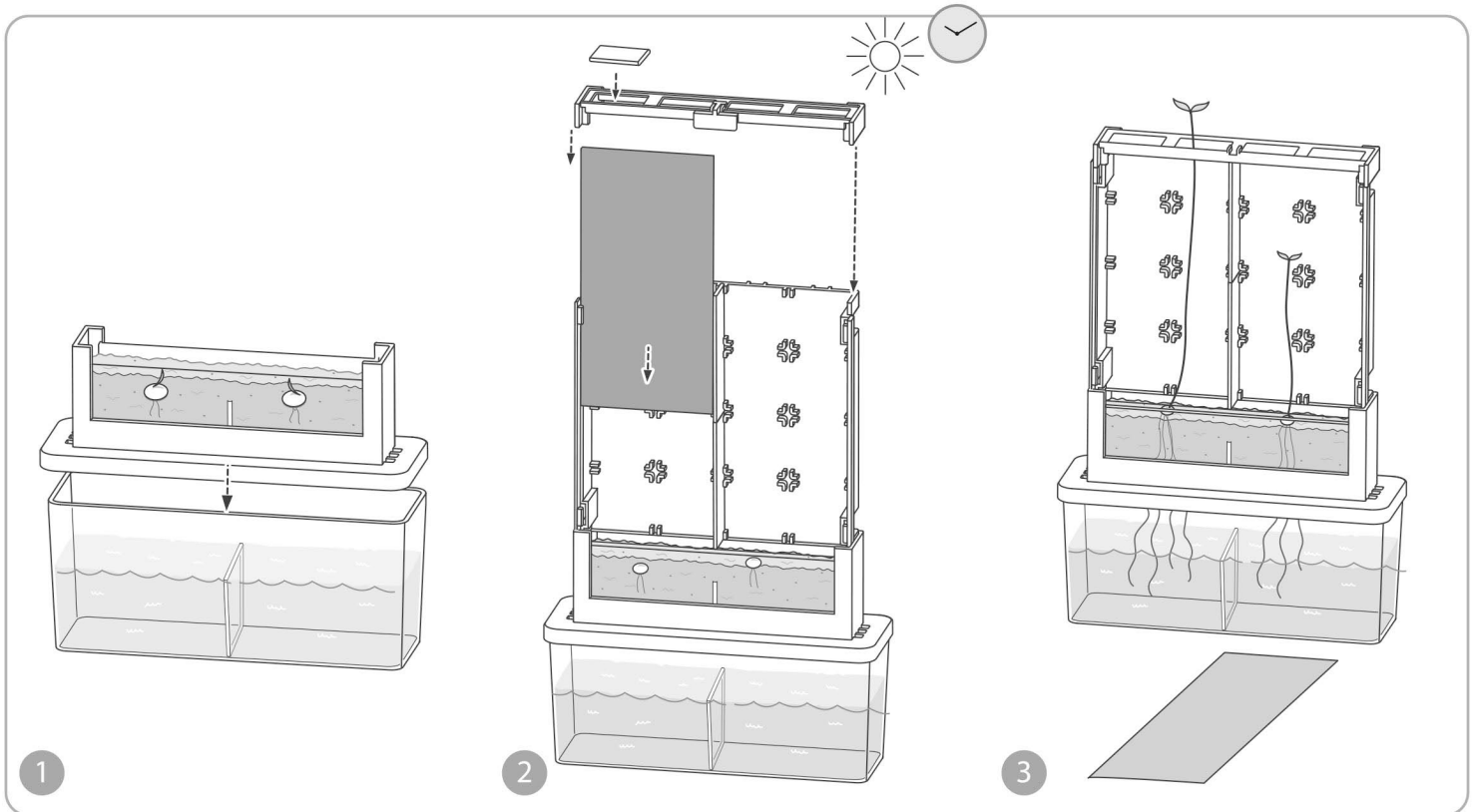
There is chance that your plant may be stuck in a dead end of the maze. And if it can't find the way out, it may wither. If this happens, carefully remove the chamber cover, remove the blocking partition and let the plant to continue to grow. The situation may also happen if the plant detects another light source through a tiny gap. If this happens, wrap the grow chamber in a piece aluminum foil to ensure it is completely light proof except for the opening in the top. As long as there is only one light source, the plant should be able to find its way out.

FUN FACTS

- Shoots can start growing a new direction within a couple of hours.
- Phototropism is the reason why plants on a windowsill grow towards the glass, because that's where the light comes from.

E. EXPERIMENT 3: BEAN RACE

Conduct a bean race and be amazed how plants grow taller in the absence of light.



EXPERIMENT STEPS

1. Repeat sections 1 and 2 above. Germinate some beans and transplant two into the soil container, one each partition. Now divide the grow chamber into two equal vertical halves using the partitions. Slot the grow chamber onto the soil container. Add the front and top cover.
2. Cover one half of the front cover with card, secure with the plastic tab, to keep that side dark. Put the whole thing on a window sill, facing the light.
3. Watch what happens over the next few days and see which plant grow faster. Which plant wins the race to the top?

HOW IT WORKS

The plant in the uncovered side gets plenty of light from different directions. Its shoot divides and grows up and outwards. The plant in the covered side only gets light from the hole above it. It puts all its energy into growing upwards towards the light, so it gets taller more quickly than the other plant.

FUN FACTS

- In forests, new trees grow towards gaps into the forest canopy where light shines through from above.
- Plants grow towards the light because they need light to grow. In their leaves, the energy from sunlight is used to combine carbon dioxide from the air and water from the soil to make sugars that the plant uses as food. The process is called photosynthesis.

F. FURTHER EXPERIMENTS

1. Growing more plants

● Try growing different sorts of plants in your maze, such as potatoes, carrots and onions. For each plant, put fresh soil in the soil container and fresh water in the base. Cut the eye and shoot from a old potato, and push this into the soil. Or try planting carrot or onion. Each time, you can watch the roots grow down and the shoots grow up.

2. The effects of acid rain

● Use the same set-up as in Experiment 1 above (that is, with one sprouting bean on each side of the soil container). Each day, add a little water to one side of the soil, and vinegar solution to the other side (make the vinegar solution by adding a teaspoon of vinegar to a cup of water).

3. Which plant grows best?

● The plant that you water with vinegar does not grow as well as the other plant. That's because acid in the vinegar harms the plant. This is what happens when acid rain falls on plants outdoors. Acid rain is made when water in the atmosphere combines with polluting gases from power stations and cars, such as sulfur dioxide and nitrogen oxides.

G. Questions & Comments

We value you as a customer and your satisfaction with this product is important to us. If you have comments or questions, or you find any part of this kit missing or defective, please do not hesitate to contact our distributor in your country. You will find the address printed on the package. You are also welcome to contact our Marketing Support Team: Email: infodesk@4m-ind.com, Fax (852) 25911566, Tel: (852) 28936241, Web site: WWW.4M-IND.COM