

Chapter 10

Plant Growth



10.1 Needs for Seed Germination

Lesson 1 Inside of a Seed

Plant life cycle starts from a seed. A young plant comes out from a seed. Is there a part inside a seed that grows into roots or leaves?



What is the structure of a seed?



Activity : Observing the inside of a seed

What We Need:

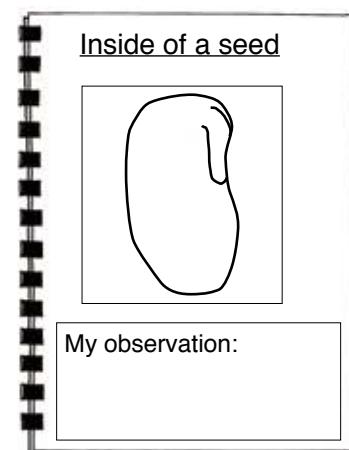
- bean seeds soaked in water overnight, cutter knife, hand lens



Be careful when you cut a bean seed with the knife.

What to Do:

- Remove the coat of the bean seed and cut it lengthwise with a knife.
- Observe the inside parts of the bean seed using a hand lens.
- Sketch its structure.
- Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss which parts of the seed will grow into roots, stem and leaves.

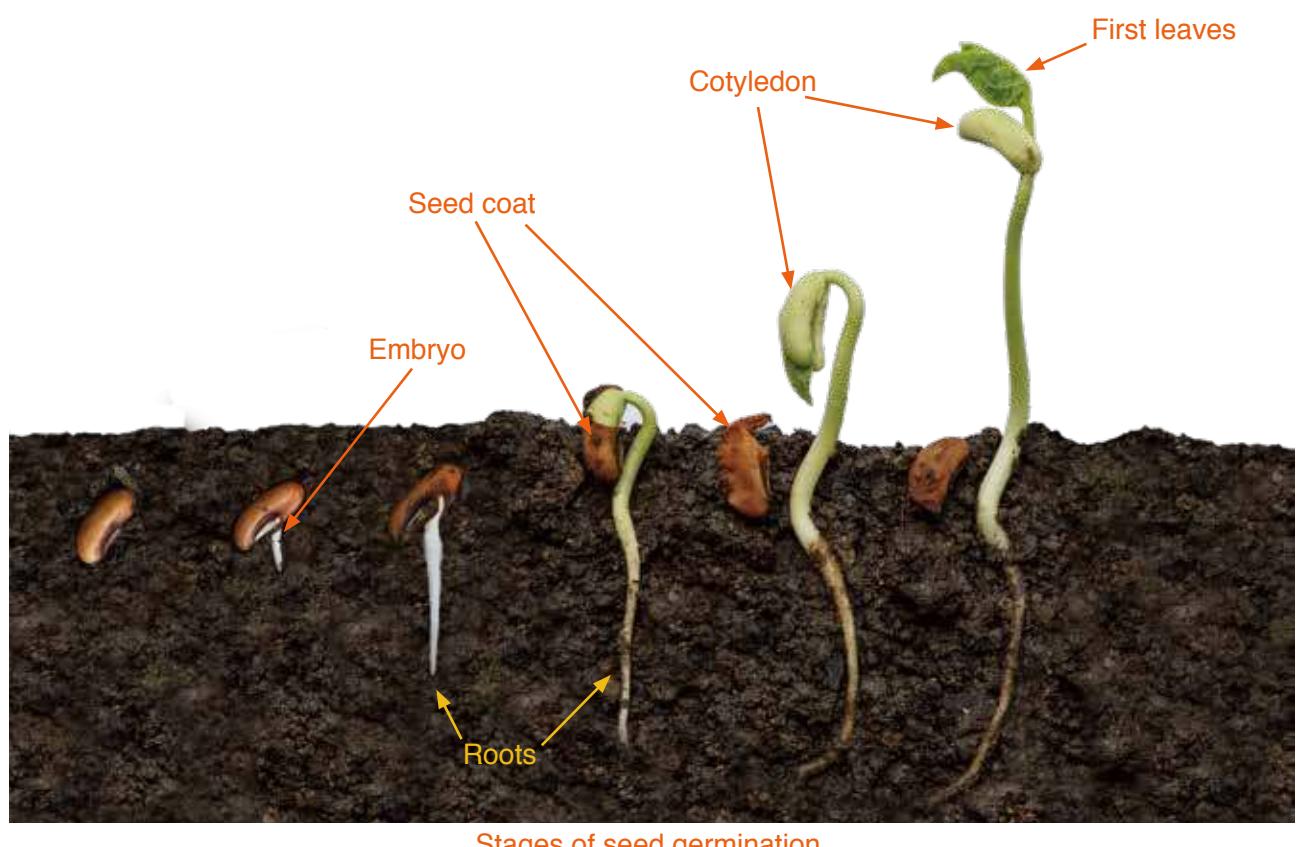
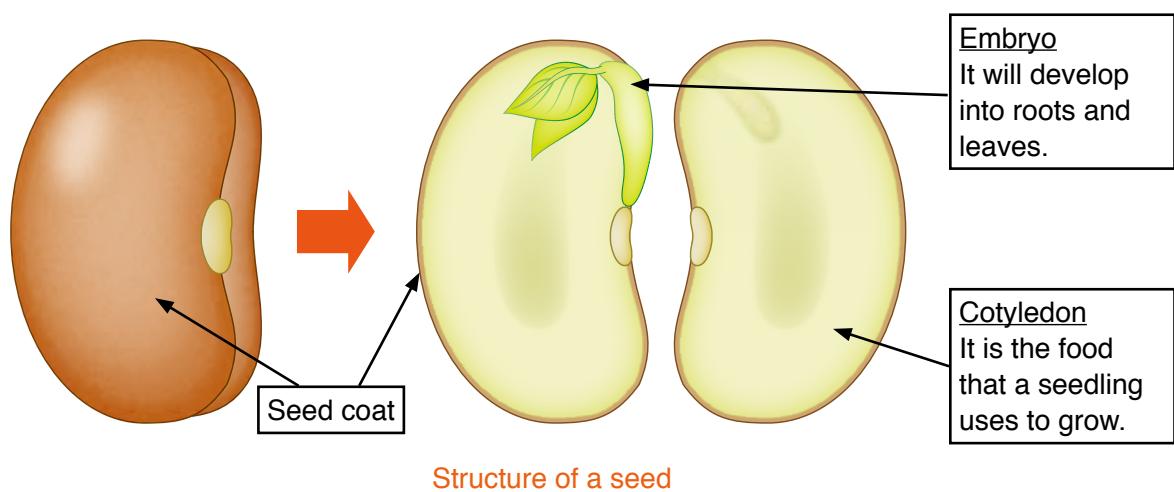


Summary

There are three main parts of a seed: seed coat, embryo and cotyledon.

Seed coat is the hard outer layer of the seed covering around the embryo and the cotyledon. It protects the embryo and the cotyledon. **Embryo** is the tiny plant inside the seed. It will develop into roots and leaves. The embryo rests inside the seed until the conditions are right for it to start to grow.

Cotyledon is the part that stores food, known as **starch**. A young plant uses the starch until it is big enough to make its own food.



Stages of seed germination.

Lesson 2

Conditions for Germination 1: Water

Plant life cycle starts from a seed. The seed sprouts and a seedling grows. The process of the seed growing into a seedling is called **germination**. What conditions do seeds need to germinate?



Do seeds need water to germinate?



Activity : With and without water

What We Need:

- bean seeds, water, tissue paper, two cups



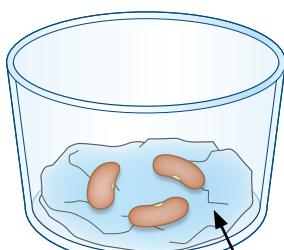
What to Do:

- Fold the tissue paper so that it will fit inside the cups A and B as shown below.
- Wet the paper in the cup labelled A until it is completely moist.
- Place the bean seeds on top of the paper in each cup and put the two cups at the same location. Always keep Cup A moist.
- Observe the seeds for a week. Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss which beans germinated and why.

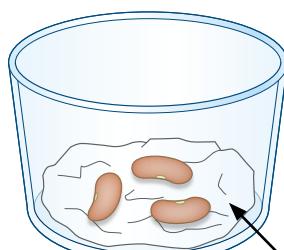
What conditions are the same or different in this activity? Can you identify them?



How can we control the conditions?



A
Tissue paper with water



B
Tissue paper without water



Result

What conditions were same or different?



We found out that the seeds placed on wet tissue paper germinated but the seeds placed on dry tissue paper did not germinate.



With water



Without water

Different conditions

The seeds were given water or not given water.

Same conditions

The seeds were exposed to air.
The seeds were placed at the same location
with the same amount of light and at the same temperature.

Summary

The germination happens inside the seed. Seeds need the right conditions to germinate. Water is one of the important conditions for seed germination. Seeds need water to germinate.

Seeds are usually dry. They might have to wait for years to start growing. When a seed comes into contact with water, water allows the seed to swell up until the seed coat splits apart and the seed embryo absorbs water. Water makes the embryo 'wake up' from its hibernation and starts growing.

From this result, what did you find out? What does a seed need to germinate?



When a seed comes into contact with water, the seed coat will absorb water.

Once the seed coat splits, the embryo starts to grow.

Lesson 3

Conditions for Germination 2: Air

When a seed comes into contact with water, the seed germinates. Are there any other conditions for seed germination?



Do seeds need air to germinate?



Activity : With and without air

What We Need:

- bean seeds, water, tissue paper, two cups



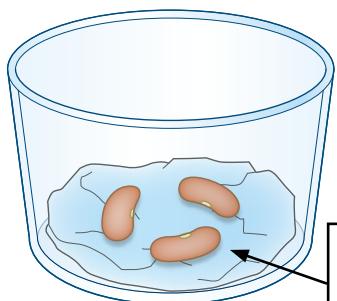
What to Do:

- Fold the tissue paper so that it will fit inside the cup.
- Place the paper in each cup and then place bean seeds on top of the paper.
- Wet the paper in Cup A until it is completely moist. Pour water in Cup B until the bean seeds are submerged.
- Place both cups at the same location.
- Observe the seeds for a week.
Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss which beans germinated and why.

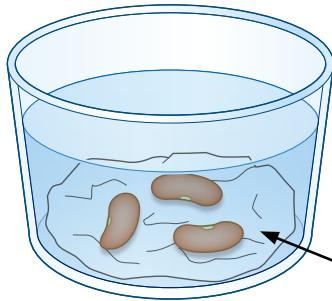
To investigate how seeds grow with and without access to air, what conditions should we control?



We must place both cups at the same place so that all the conditions should be the same EXCEPT access to air.



Bean seeds placed on the wet paper.



Bean seeds submerged.

Result

We found out that the bean seeds placed on wet tissue paper germinated but the bean seeds that were submerged did not germinate.



Bean seeds placed on wet tissue paper



Bean seeds submerged

Different conditions

The seeds were exposed to air or not exposed.

Same conditions

The seeds were given water.
The seeds were placed at the same location with the same amount of light and at the same temperature.

Summary

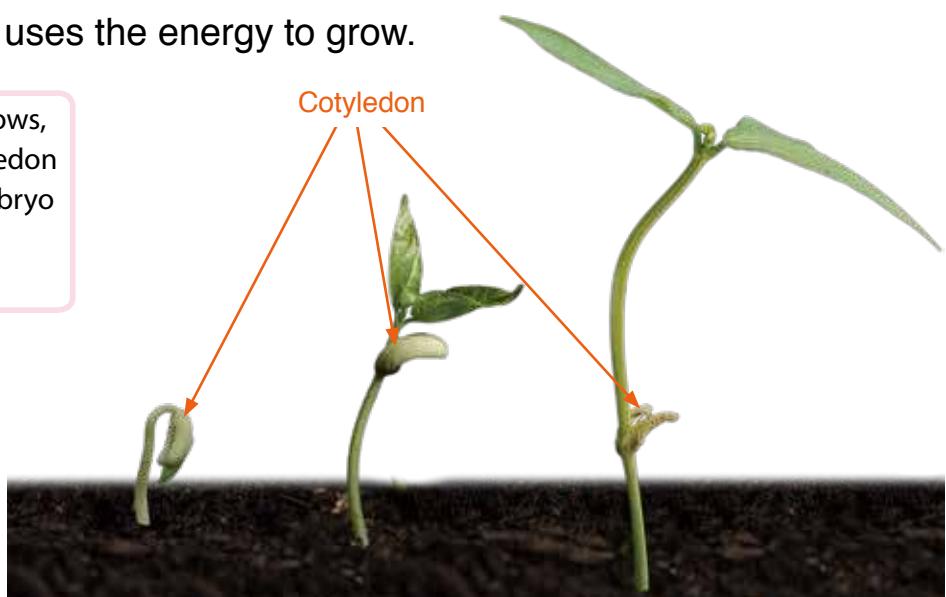
A bean seed placed on wet tissue paper is exposed to air. On the other hand, a bean seed submerged is not exposed to air because it is covered with water. From this result, we find that seeds need air to germinate.



From this result, what does a seed need to germinate? A bean seed submerged, this means?

Seeds need oxygen in the air for germination. Seeds cannot make food like adult plants do. Instead, they use the oxygen together with starch stored in seeds to make energy. When oxygen gets to the seeds, the oxygen helps the embryo burn the starch stored in the cotyledon. Burning the starch produces energy. The embryo uses the energy to grow.

The more an embryo grows, the more withered cotyledon is. This is because an embryo uses starch stored in the cotyledon to grow.



Stages of seed germination.

Lesson 4

Conditions for Germination 3: Temperature

Seeds need water and air to germinate. How about temperature? Does seed germination have a relationship with temperature?



Do seeds need proper temperature to germinate?



Activity : Warm or cold temperature

What We Need:

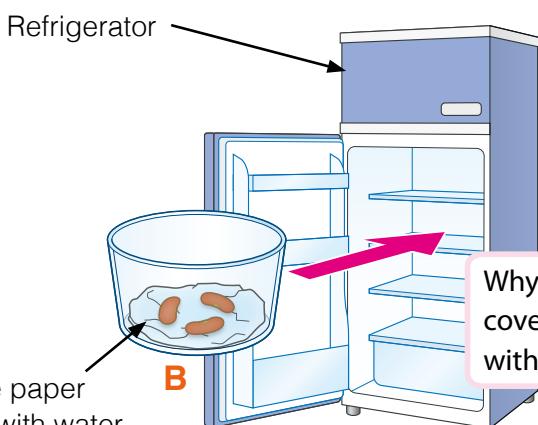
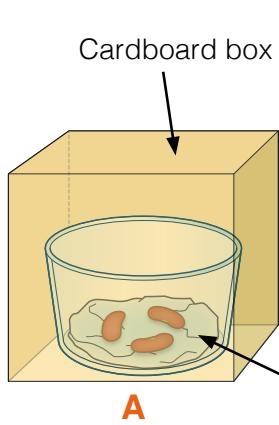
- bean seeds, water, tissue paper, two cups, cardboard box



What to Do:

- Fold the tissue paper so that it will fit inside the cup.
- Place the paper in each cup and wet the paper in both cups until it is completely moist. Put the bean seeds on top of the paper in each cup.
- Put one of the cups in a refrigerator. Place another cup in a classroom and cover it with the cardboard box.
- Observe the seeds for a week. Record your observations in your exercise book.
- Share your findings with your classmates. Discuss how temperature affects seed germination.

All the conditions for seeds should be the same EXCEPT the difference in temperature. What conditions should be the same?



Why do we have to cover one of the cups with the cardboard box?



Result

It is dark inside a refrigerator, so we covered a bean seed placed in a classroom with a box in order to make it dark.



We found out that the bean seeds placed in a refrigerator did not germinate but the bean seeds placed in a classroom germinated.



At room temperature



At cold temperature

Different conditions

The seeds were placed at different temperatures.

Same conditions

The seeds were given water.

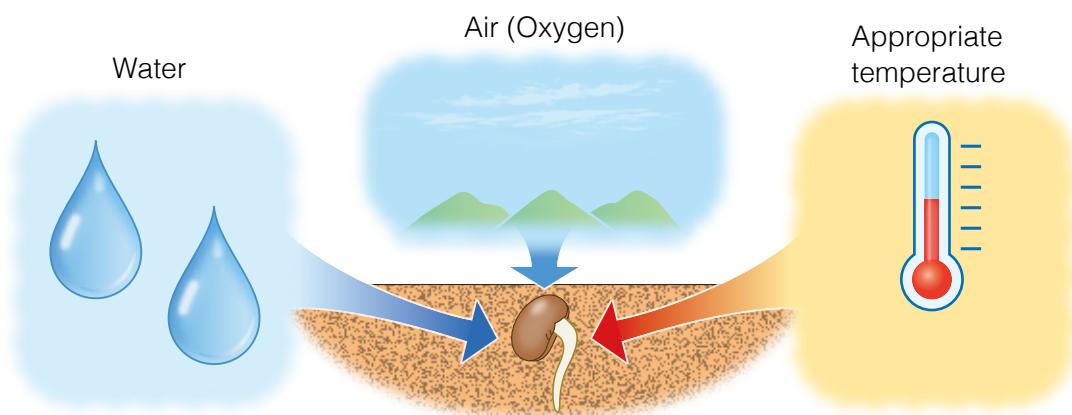
The seeds were exposed to air.

The seeds were not exposed to light (dark place).

Summary

The temperature in a classroom is warmer than that in a refrigerator. This means that seeds need an appropriate temperature for germination. Without the proper temperature, the seeds will not germinate. In general, most seeds will germinate at temperatures between 10°C and 35°C. Warmth speeds up and improves the process of germination. Seeds seem to have a system that makes them wait for warmer temperatures before sprouting. Through the three activities, we find that seeds need three conditions for germination: water, air (oxygen) and appropriate temperature.

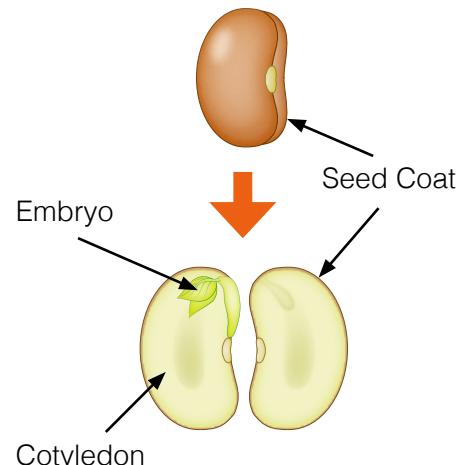
From this result, what does a seed need to germinate?



Seeds need water, air and appropriate temperature to germinate.

Inside of a Seed

- There are three main parts of a seed: seed coat, embryo and cotyledon.
- The seed coat is the hard outer layer of the seed covering around the embryo and the cotyledon. It protects the embryo and the cotyledon.
- The embryo is the tiny plant inside the seed. It will develop into roots and leaves.
- The cotyledon is the part that stores food known as starch for the young plant.



Conditions for Seed Germination 1: Water

- Water is one of the important conditions for seed germination. Seeds need water to germinate.
- When a seed comes into contact with water, it allows the seed to swell up until the seed coat splits apart, and the seed embryo absorbs water.



Germination of bean

Conditions for Seed Germination 2: Air

- Seeds need oxygen in the air for germination.
- When oxygen gets to the seeds, the oxygen helps the embryo to burn the food stored in the cotyledon. Burning the food produces energy to germinate and grow.



Conditions for Seed Germination 3: Temperature

- Seeds need proper temperature for germination.
- Warmth speeds up and improves the process of germination.
- Seeds seem to have a mechanism that makes them wait for warmer temperature before sprouting.

Exercise

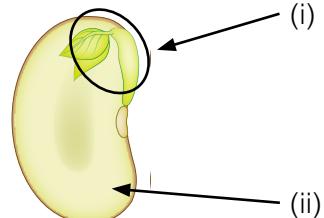
10.1 Needs for Seed Germination

Q1. Complete each sentence with the correct word.

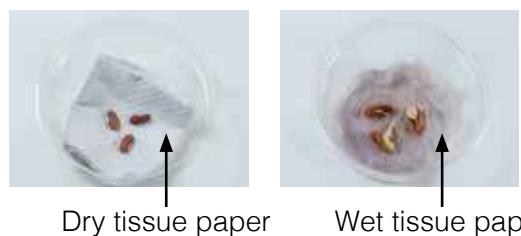
- (1) The cotyledon and embryo are covered by the _____.
- (2) The _____ causes the seed to swell up and split the seed coat apart allowing the embryo to come out.
- (3) The _____ from the air helps embryo burn the food stored in cotyledon.
- (4) Warm _____ speed up the process of germination.

Q2. Choose the letter with the correct answer.

- (1) What is the correct combination of the name of seed parts (i) and (ii)?
 - A. (i) is pollen and (ii) is cotyledon.
 - B. (i) is cotyledon and (ii) is embryo.
 - C. (i) is seed coat and (ii) is embryo.
 - D. (i) is embryo and (ii) is cotyledon.

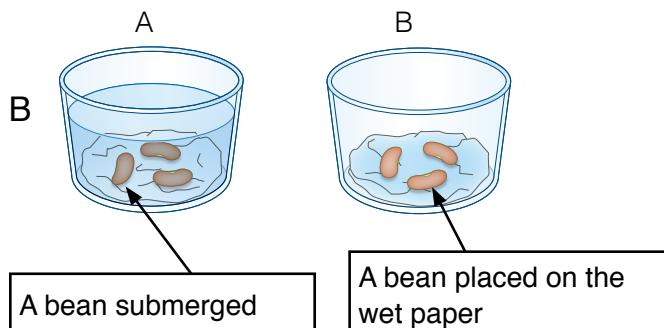


- (2) According to the experiment shown below, what is needed for seed germination?
 - A. Water
 - B. Water and sunlight
 - C. Air
 - D. Darkness and air.



Q3. Answer the question below.

What are the conditions in cup A and B that are same and different?



Q4. Greg got some dry corn seeds and planted them in his garden. After five days, he did not see any plants growing from the spot he planted the seeds. What could be the two possible reasons for this?

10.2

Needs for Plant Growth

Lesson 1

Conditions for Plant Growth 1: Water

After germination, a seedling grows and changes into an adult plant.

What does a plant need in order to grow well? What types of conditions are necessary for plant growth?

Seeds need water, air and appropriate temperature to germinate. How about young plants? What conditions do they need to grow? Let's predict!



Do plants need water to grow?



Activity : With and without water

What We Need:

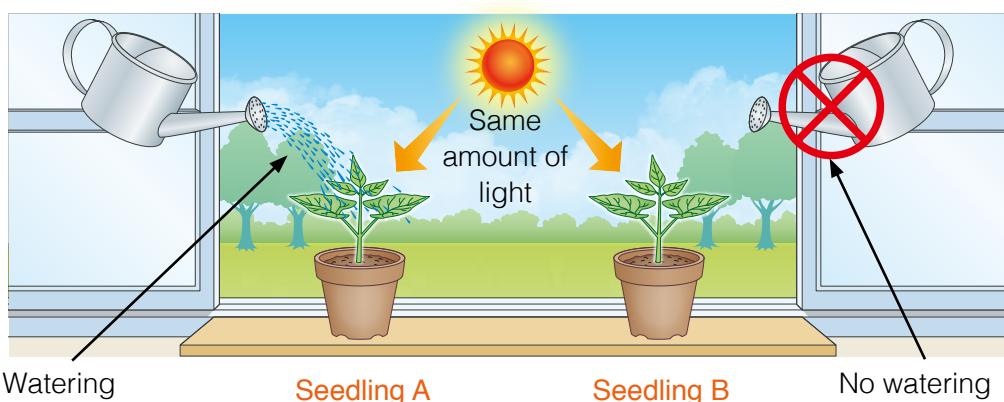
- two same sized seedlings in plant pots, water



What conditions should be the same or different in order to see if plants need water for growth?

What to Do:

- Place seedlings A and B near the classroom window.
- Water seedling A every day, but do not water seedling B.
- Observe the seedlings for a week. Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss what happened to the seedling with or without water added and what it needs to grow.



Result

Why do we have to control conditions?



We found out that the plant that was watered grew well but the plant that was not watered did not grow well.



Without water



With water

Different conditions

With and without water.

Same conditions

The same amount of light.

The same temperature.

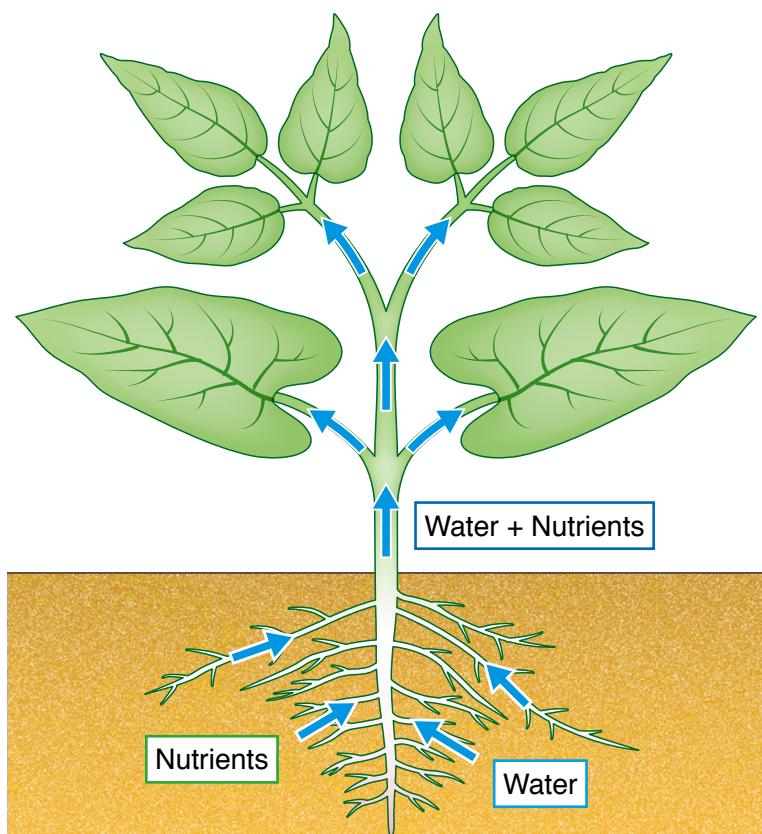
Summary

From this result, what do plants need to grow?



Plants need water to grow. Water is the main component in plants. Without water, plants cannot grow and survive. Water can be absorbed through the roots in the soil.

Water helps the plants to move nutrients from the soil up its stems and leaves. Water keeps the plant moist and flexible. Plants also use water to lower their temperature. Water also helps the plant to make its own food. The moving water inside the plant helps carry food to all parts of the plant.



Lesson 2

Conditions for Plant Growth 2: Light

Plants need water to grow. Are there any other conditions for plants to grow?



Do plants need light to grow?



Activity : With and without light

What We Need:

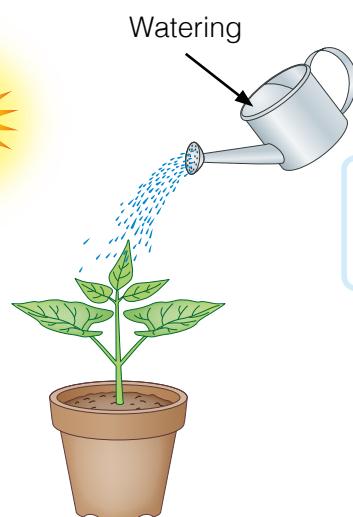
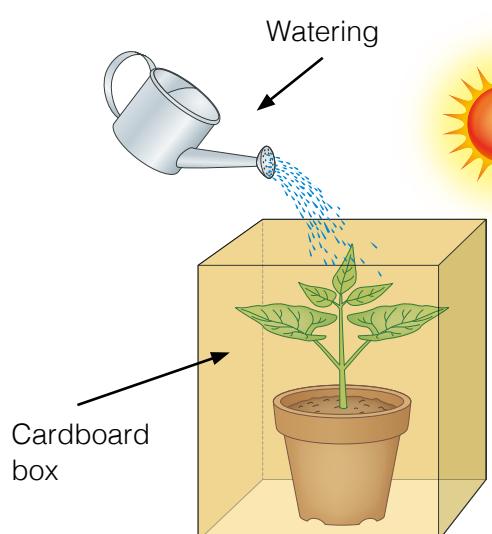
- two same sized seedlings in plant pots, water, cardboard box



What to Do:

- Place both seedlings in a sunny place but cover one of the seedlings with a cardboard box.
- Water both seedlings every day.
- Observe the seedlings for a week. Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss what happened to both seedlings and what plants need to grow.

To investigate whether plants need light for growth, how should we control the conditions? What conditions should be the same?



Why do we have to cover one of the seedlings with a cardboard box?



Result

If the plant is covered with the cardboard box, it is dark inside the box. Why is it dark inside the box?



We found out that the plant covered with the cardboard box did not grow well but the plant that was not covered with the cardboard box grew well.



A plant covered with a box.



A plant without a box.

Different conditions

With and without light.

Same conditions

With water.

The same temperature.

Summary

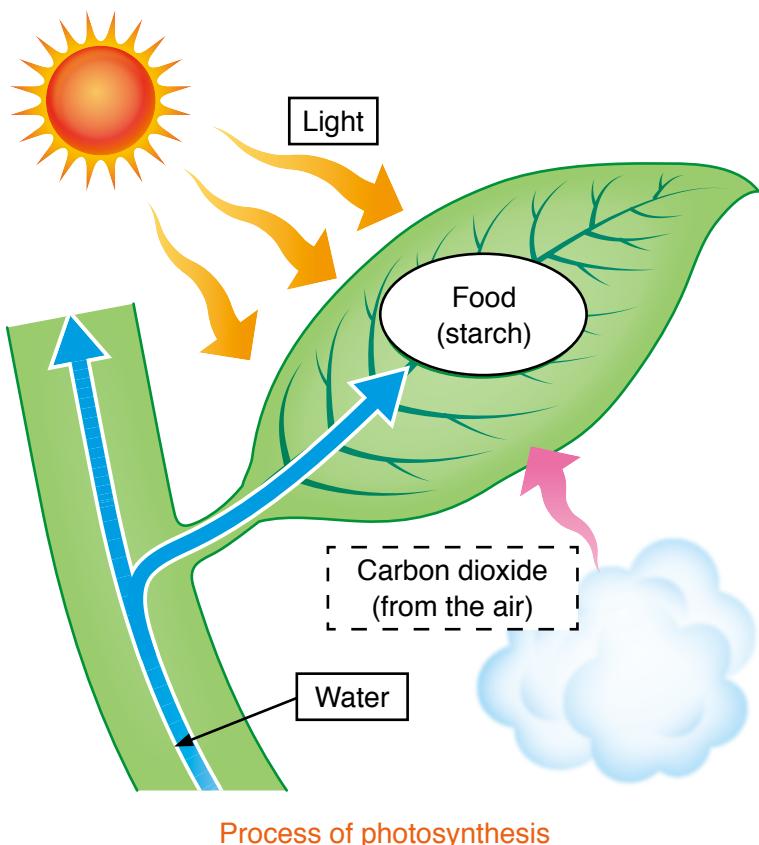
From this result, what do plants need to grow?



Light is very important for plants to grow. Plants are able to make some of their own food by using light. Plants use the food as the energy for their growth.

Plants need not only water and light but also air (carbon dioxide) to make their own food for their growth. The process by which plants make their own food (starch) from carbon dioxide and water by using light is called **photosynthesis**.

Photosynthesis usually takes place in the leaves.



Lesson 3

Conditions for Plant Growth 3: Fertiliser

Plants need water and light to grow. How can we make plants grow well? Can fertilisers work on plant growth?



Do plants need fertiliser to grow well?



Activity : With and without fertiliser

What We Need:

- two same sized seedlings in plant pots, water, fertiliser



What to Do:

- Form a group with your classmates and predict:
 - What conditions should be different or same in order to see if plants need fertilisers to grow well?
 - How can you investigate whether your predictions are correct or not?
- Based on your predictions, make a plan for your investigation and try it out.
- Observe the seedlings for a week and record your observations in your exercise book.
- Share your ideas with your classmates. Discuss the conditions you controlled, your investigation plan and the results of your investigation.

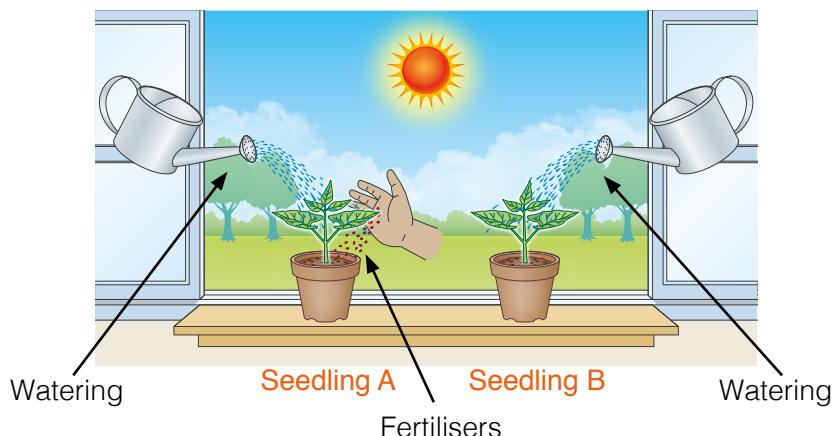
Where should we place the seedlings? All the conditions should be the same EXCEPT for access to fertilisers.



Result

We found out that both seedlings were put in the same place and had access to water, light and temperature. Seedling A had fertiliser and Seedling B did not. The seedling with fertiliser grew very well. On the other hand the seedling without fertiliser did not grow well.

How did you control the conditions? Is your prediction correct or not?



Different conditions

With and without fertilisers.

Same conditions

With water.
Same amount of light.
Same temperature.



If your prediction is not correct, think about what was wrong?



Summary

Fertilisers help plants grow well. They provide nutrients such as nitrogen and potassium to plants to help boost their growth. Plants need nutrients to maintain their growth. The nutrients are necessary for producing green leaves, big flowers and strong roots.

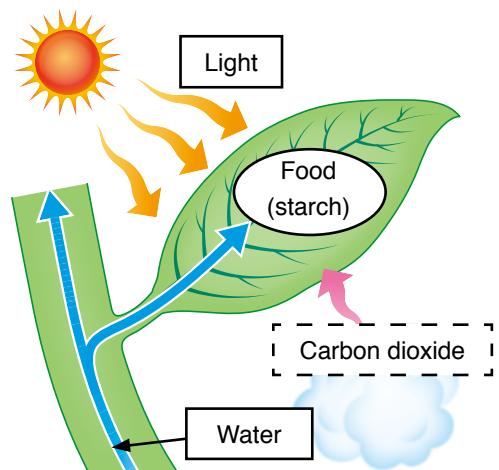
From the three experiments we found out that plants need **water, air (carbon dioxide)** and **light** to grow. The **nutrients** also help plants grow well.

Conditions for Plant Growth: Water

- Without water plants cannot grow and survive.
- Water can be absorbed through the roots from the soil and helps to move nutrients from the soil up its stems and leaves.
- Water keeps the plant moist, flexible and lowers its temperature.
- Water also helps the plant make its own food.
- The moving water inside the plant helps carry food to all parts of the plant.

Conditions for Plant Growth: Light

- Light is important for plants to grow.
- Plants are able to make their own food by using light.
- Photosynthesis is the process by which plants make their own food (starch) from carbon dioxide and water by using light.



Conditions for Plant Growth: Fertiliser

- Fertilisers help plants grow well.
- Fertilisers provide nutrients to plants and give plants an additional growth boost.
- Plants need nutrients to maintain their growth. The nutrients are necessary for making green leaves, big flowers and strong roots.



With fertiliser



Without fertiliser

Exercise

10.2 Needs for Plant Growth

Q1. Complete each sentence with the correct word.

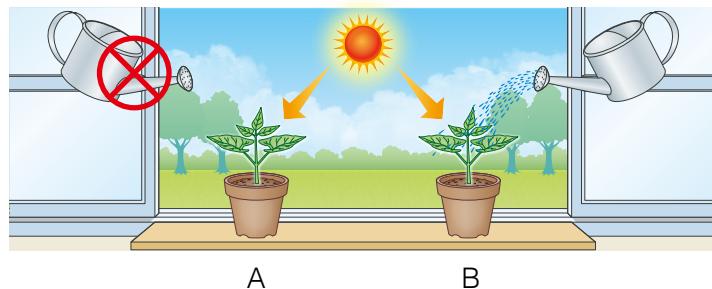
- (1) Water helps the plant move _____ from the soil up its stems and leaves.
- (2) Plants can get nutrients from _____ for growth.
- (3) Plants use _____ to keep itself moist and flexible.
- (4) Plants need water, _____ and nutrients to grow.
- (5) The process by which plants make their own food from carbon dioxide and water by using light is called _____.

Q2. Choose the letter with the correct answer.

- (1) Which of the following sentences is not correct about the ways that plants use water? Plants use water to
 - A. move nutrients from the soil to its parts.
 - B. make their own food by using sunlight.
 - C. keep them growing big and tall in a short time.
 - D. keep them cool in hot temperature.
- (2) What do plants make as their own food in the process of photosynthesis?
 - A. Water
 - B. Starch
 - C. Carbon dioxide
 - D. Sunlight

Q3. Answer the question below.

What are the conditions in plants A and B that are similar and different?



Q4. Explain what the nutrients from the fertiliser would do to the plant when applied?

How long does it take to germinate and grow Mango from a seed? What are things that affect its growth?

The pulp of the seed of a mature mango fruit must be removed. Store the seed in an open container of water at room temperature and place it in a warm place. The water must be changed every two days during this time.

After 7 to 14 days the seed will start to germinate. Once the seed begins to produce shoots, it must be planted in a pot of compost. If the seed does not sprout within this time, plant the seed in a 10 cm pot of compost and seal the pot in a plastic bag. The plant must be watered frequently and keep it sealed in a warm place for up to 60 days or until shoots appear.

After planting, it takes mango trees about one year to reach 90 to 120 cm tall. It must be transplanted. Between two to four years mango tree will produce fruit. Once the fruit appears, it takes 3 to 6 months to mature.

Mature mango trees can reach heights and spreads of more than 12 m. Temperature is the main factor in a mango tree's growth. Warmth makes them grow faster and mature more quickly. The varieties of mangoes also have certain influences. If the pulp is removed from the mango seed, it may take the seed up to 7 weeks to germinate.



Chapter Test

10. Plant Growth

Q1

Complete each sentence with the correct word.

- (1) The process of the seed growing into a seedling is _____.
- (2) The _____ of the seed will develop into roots and leaves.
- (3) Plants need nutrients to maintain their _____.

Q2

Choose the letter with the correct answer.

- (1) Water and fertiliser were given to both plants shown below. Which condition was not given to the plant on the right?

- A. Salt
- B. Sunlight
- C. Oil
- D. Electricity



- (2) What conditions do seeds need to germinate?

- A. Water, air and appropriate temperature.
- B. Water, light and air.
- C. Water, soil and appropriate temperature.
- D. Air, appropriate temperature and light.

- (3) Which of the following statements does not describe a function of water in plants? Water helps the plant

- A. make its own food.
- B. get rid of the nutrients into soil.
- C. moves the nutrients to all parts of the plant.
- D. keep moist and flexible.

- (4) Which of the following is the correct explanation about cotyledon?

- A. Cotyledons make the plant body cool.
- B. Cotyledons provide light to make food.
- C. Cotyledons develop into the leaves.
- D. Cotyledons store and provide food to the seed.



Q3

(1) After germination, what three conditions do plants need in order to grow well?

1. _____
2. _____
3. _____

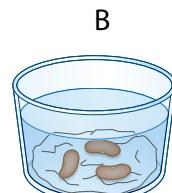
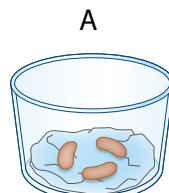
(2) What is the process by which plants make their own food from carbon dioxide and water by using sunlight?

(3) What is the name of the food that the plant makes in the process (2)?

(4) A seed has a hard covering that covers its inside parts. What could be the reason for the seed coat to be hard?

Q4

(1) Irene prepared two set-ups as shown on the right in order to investigate the condition of seed germination. Bean seeds are placed on wet paper in setup A while bean seeds in set-up B are submerged in the water. Explain why she prepared the two set-ups in the experiment.



Bean seeds placed on the wet paper.

Bean seeds submerged.

(2) Ambai observed that the seeds that were moistened and placed in an appropriate temperature and exposed air germinated. If she wants to keep the remaining seeds for the following year, how should she store the seeds? Write two ways to prevent the seeds from germinating.
