4 Reproduction in Plants

Plants reproduce

In Grade 4, you studied the parts of a flower. Look at the following pictures.

Refer also to Grade 4, Unit 3.

Bushy Cassia plant

Flower of Bushy Cassia

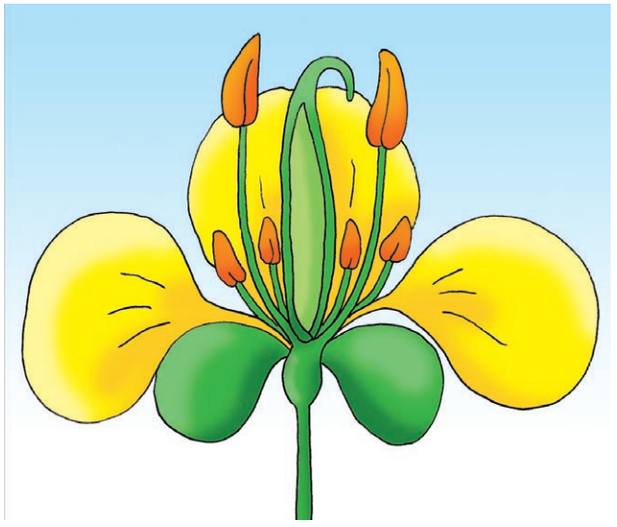


Diagram of Bushy Cassia flower

- Locate and name the parts of the flower.

All living things reproduce. In Unit 3, you learnt that humans reproduce by **sexual reproduction**.

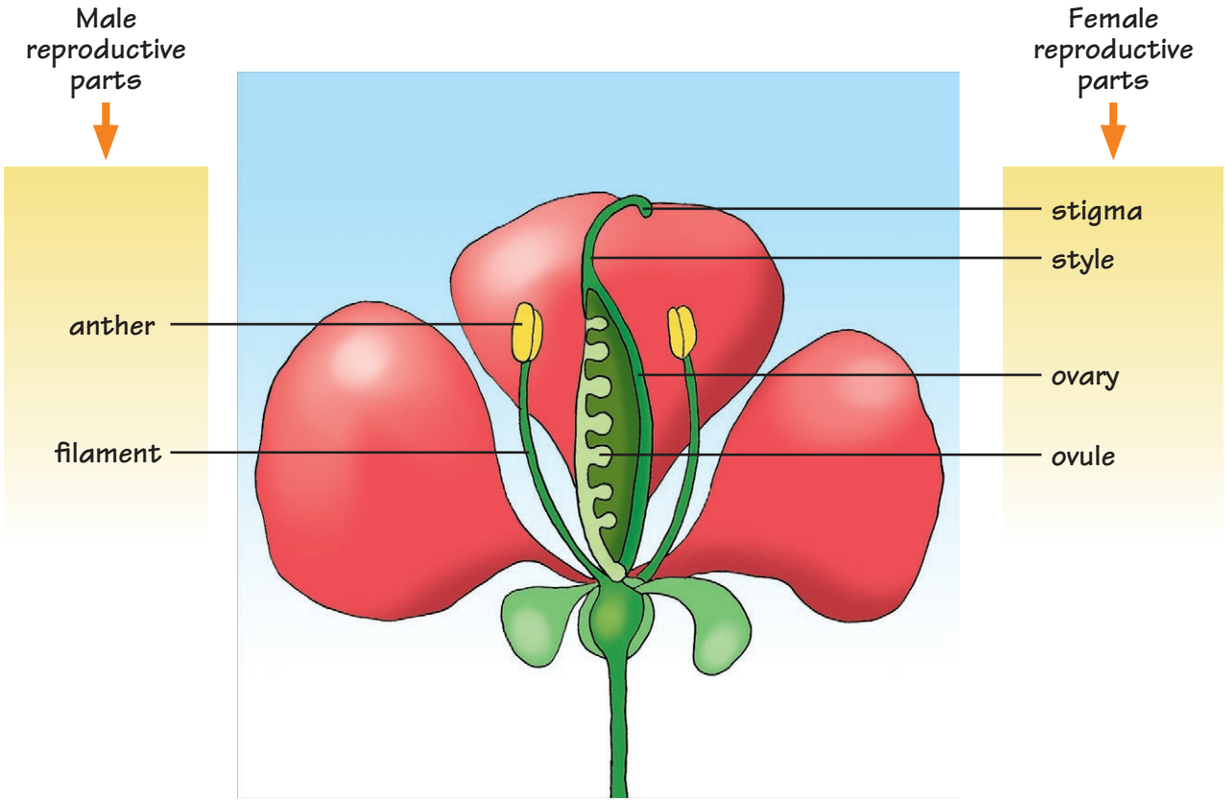
In this unit, you will learn that flowering plants can also reproduce by sexual reproduction. This involves the formation of **seeds**. You will also learn that some flowering plants can reproduce *without* seeds. This is called **asexual reproduction**.

Let's begin!

Link it!
Parts of a flower
Grade 4, Unit 3

Reproductive parts of a flower

Flowers are the reproductive parts of a flowering plant. Most flowers have male and female reproductive parts.



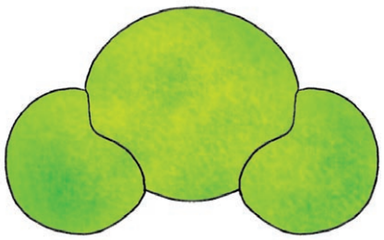
Reproductive parts of a flower

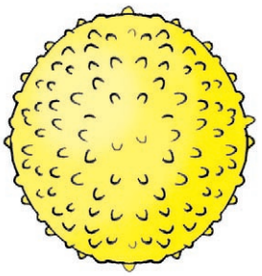
The male part of a flower has two parts: the **anther** and the **filament**.

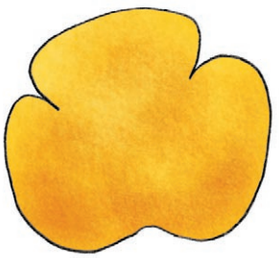
The filament supports the anther. The anther makes **pollen**.

Pollen looks like a powder. Inside each pollen grain is a **male sex cell**.

Different flowers have different kinds of pollen. Here are some examples.







The female part of a flower has three parts: the **stigma**, the **style** and the **ovary**.

The stigma has a sticky surface. The style holds the stigma and leads to the ovary.

Inside the ovary are **ovules**. Inside each ovule is a **female sex** cell.

Go to a garden in your school or in a park. Use a magnifying glass to identify the male and female parts of a flower. Can you see any pollen on the anthers?

Fun Science

On most plants, each flower has both male and female reproductive parts. On some plants, flowers have either male or female parts, for example. kiwi and papaya.

Male papaya flower

Female papaya flower

WB ★ Activity 1

Stages in reproduction

Flowering plants reproduce by **sexual reproduction**. The male sex cell in the pollen grain fertilises the female sex cell in the ovule. The fertilised cell then develops into a seed that can grow into a new plant.

The complete process of reproduction involves four stages.

1. Pollination
2. Fertilisation and the formation of seeds and fruits
3. Dispersal of seeds
4. Germination

We will look at each of these processes.

Pollination

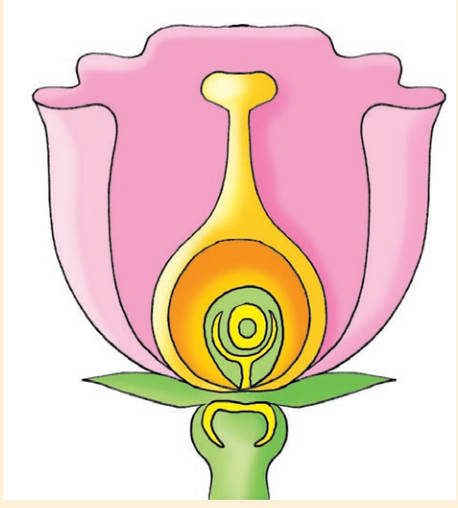
In sexual reproduction, male sex cells fertilise female sex cells. In flowering plants, the male sex cell is in the pollen. The female sex cells are in the ovules.

- How do the male and female sex cells meet? Answer given below.

For fertilisation to occur, pollen first moves from an anther to a stigma. This is called **pollination**.

There are two kinds of pollination.

1. **Self-pollination.** Pollen moves from the anthers to the stigma of the same flower.



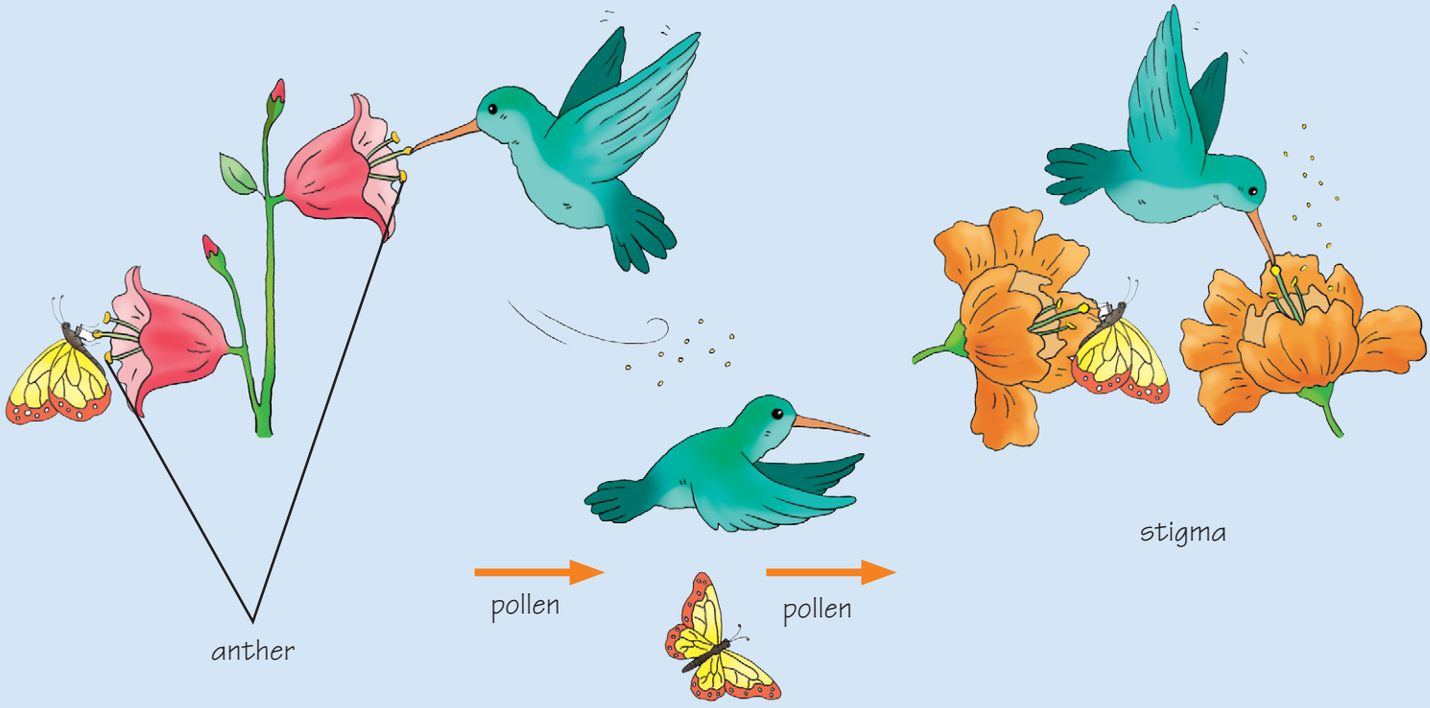
Self-pollination

2. **Cross-pollination.** Pollen moves from the anthers of one plant to the stigma of another plant.

Cross-pollination

In nature, pollination happens in two main ways

1. By birds and insects
2. By wind



Animal pollination

Birds, bees, butterflies and other insects visit flowers. Pollen from anthers sticks to their heads, bodies or legs. The animals then fly to another flower. Pollen comes off the animal and onto the stigmas of this flower.

Bird

Butterfly

Bee

To attract insects and birds, flowers often have:

- large, coloured petals.
- sweet nectar which the animals like to eat.
- rough or sticky pollen that sticks onto the bodies of the animals.

Thinking

1. Grass pollen is smooth. It does not need to be sticky. Why?
2. Some flowering plants live underwater. Suggest how pollen moves from one flower to another?

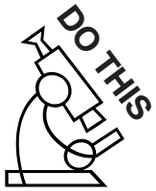
1. Grass pollen does not need to stick to the bodies of birds or insects.
2. Water currents carry the pollen from one flower to another.

Wind pollination

Plants, such as grass and wheat, have small flowers with no coloured petals and no nectar. They cannot attract insects or birds. In these plants, wind carries the pollen from one flower to another. To be sure that pollination occurs:

- the plants produce a lot of pollen.
- the pollen is light so that it can float in the wind.

Wheat is pollinated by wind.



Again visit a garden in your school or a park.
Can you see any insects in or around the flowers?
What kinds of insects are there?
Do they move from flower to flower? How do they help in pollination?

Fun Science

1. Some orchids have flowers that look and smell like female wasps. This attracts male wasps. When the male wasp tries to '*mate*' with the flower, its body gets covered with pollen. When it tries to 'mate' with another flower, this pollen falls onto the stigmas.

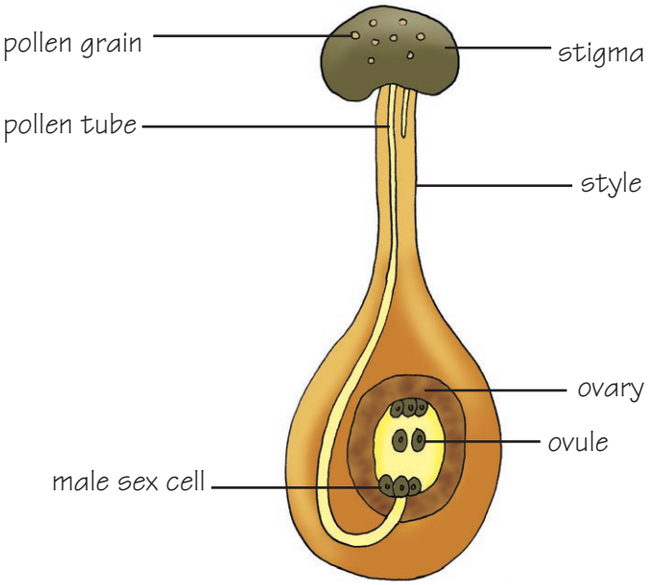
Use this example to revise with the class the idea of adaptation (see Grade 5, Unit 4).

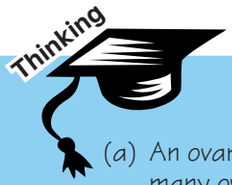
2. Sometimes people grow plants because they want a special colour or a large fruit. Instead of leaving the pollination to nature, people pollinate flowers. To do this, they brush pollen grains from the anther of one flower onto the stigma.

People can pollinate flowers.

Fertilisation

When a pollen grain falls onto a stigma, it produces a tube called a **pollen tube**. This tube grows down through the style and into the ovary. The male sex cell moves down its pollen tube and joins with the female sex cell in an ovule. Other male sex cells fertilise female sex cells in other ovules.





(a) An ovary can contain many ovules. How many ovules does the ovary in this diagram have?
(b) How many pollen tubes must grow to fertilise all the ovules in this ovary?

(a) There are two ovules so two seeds will form after fertilisation.
(b) Two.

Fruits and seeds

After fertilisation, the ovary changes to form a **fruit**. Inside the ovary, the ovules become **seeds**. Most of the other parts of the flower die and drop off.

Flower of the passionfruit

after fertilisation

A passionfruit

- Here are some fruits. Can you see the seeds inside?

Rambutan

Watermelon

Durian

Dragon fruit

Tomato

Papaya

Peanut

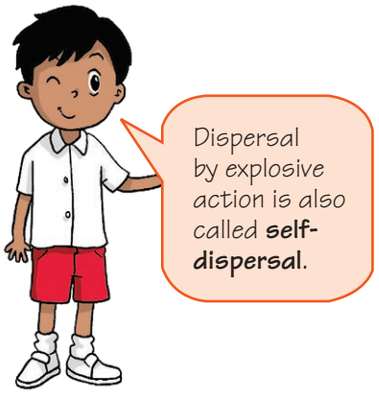
Thinking

Edible fruits – rambutan, durian, watermelon, dragon fruit, tomato, papaya.
Edible seeds – peanut, sun flower.

Look at the pictures of the fruits and seeds. Which have fruits that we eat? Which have seeds that we eat?

We can eat some fruits and seeds. For watermelon and durian, we eat the fruit. For peanuts and beans we eat the seeds.

In Java, saga seeds are roasted, shelled, then eaten with rice



Dispersal of seeds

Seeds must move from the plant to a place where they can grow. This movement is called **dispersal**.

Seeds are dispersed by the following methods:

- Wind dispersal
- Animal dispersal
- Water dispersal
- Explosive action

The pictures below show the different kinds of dispersal.

Wind dispersal

Dandelion seeds are small and light and have a 'parachute'.

Maple seeds have 'wings'.

The parachutes and wings help the seeds to float in the air and move long distances.

Water dispersal

Plants that grow in or near the rivers or seas drop their fruits or seeds in the water. The water carries them to new places.

Coconuts float in water.

Lotus seeds are also dispersed by water.

Animal dispersal

Some animals eat the fruit and throw away the seeds. Other animals eat the fruit and seeds. The seeds are not digested and pass through the animals' digestive system.

This monkey eats the fruit and throws away the seeds.

This bird eats berries. The seeds pass through the bird.

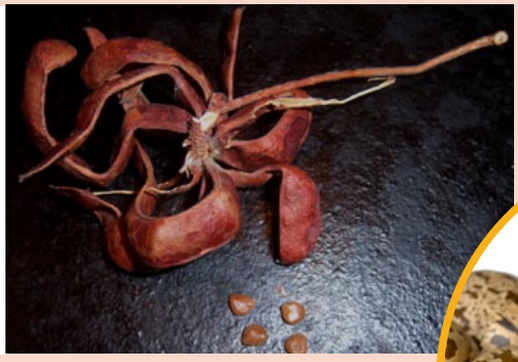
Some fruit and seeds have hooks. They stick to the hair or feathers of animals and are carried to new places. Examples are grass and burdock.

Burdock fruit has hooks.

Explosive action

In some plants, the seeds are in pods. When pods are dry, they split open. The seeds shoot into the air in different directions. Examples are peas, saga and beans.

Beans in a pod



Saga pods with seeds

In plants without pods, the fruit splits open and disperse the seeds. An example is rubber.

Rubber seeds

Thinking

1. Which dispersal method can often carry seeds to great distances?
2. Humans also help to disperse seeds. Give examples.

1. Water, wind and animals. Note: Seeds carried by animals are usually dispersed the greatest distances.
2. E.g. Seeds stick to our clothes when we walk through a garden or forest. We eat fruit and seeds which pass through our digestive system. Farmers plant seeds in gardens.

- Why is dispersal important? Answer given below.

Without dispersal, all the seeds fall in one place. There is overcrowding. There will not be enough water or sunlight for them all the growing plants. Many will not grow well. Others will die. Dispersal prevents overcrowding.

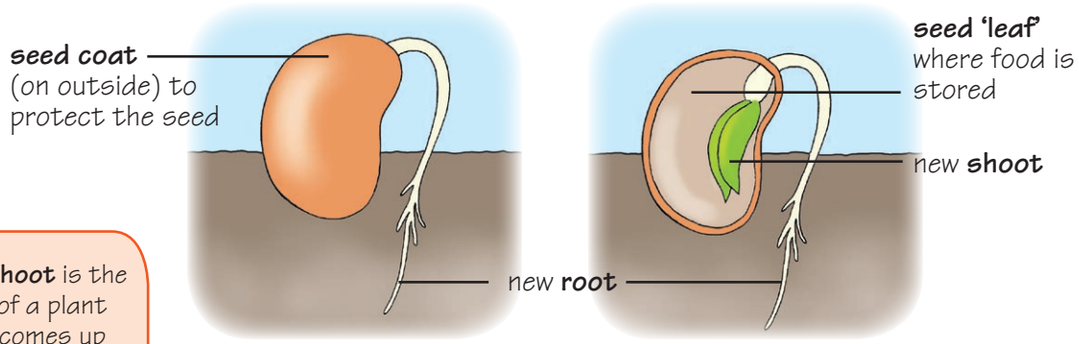
WB ★ Activity 2

Germination

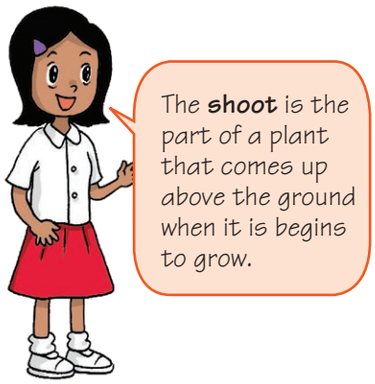
After dispersal, seeds start to grow into new plants. This is called **germination**.

A seed requires food, air, water and warmth to germinate.

The diagram below shows the main parts of a bean seed.

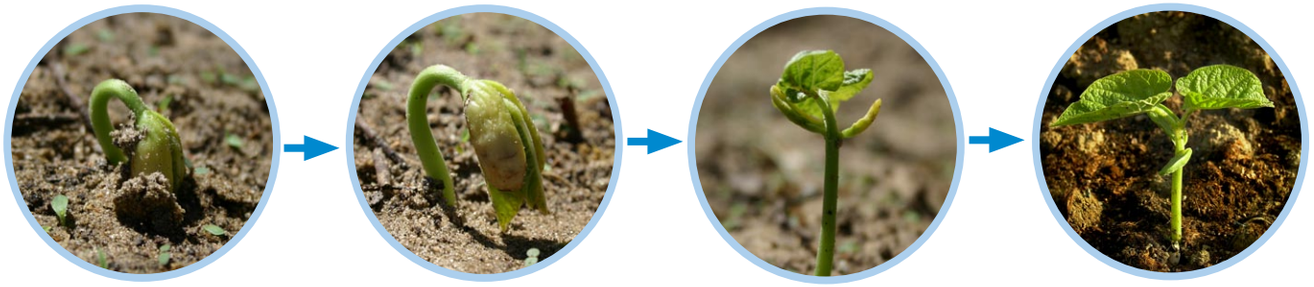


External view Inside view



During germination, the young plant uses food stored in the seed.

The diagram below shows the stages in the germination of a bean seed.



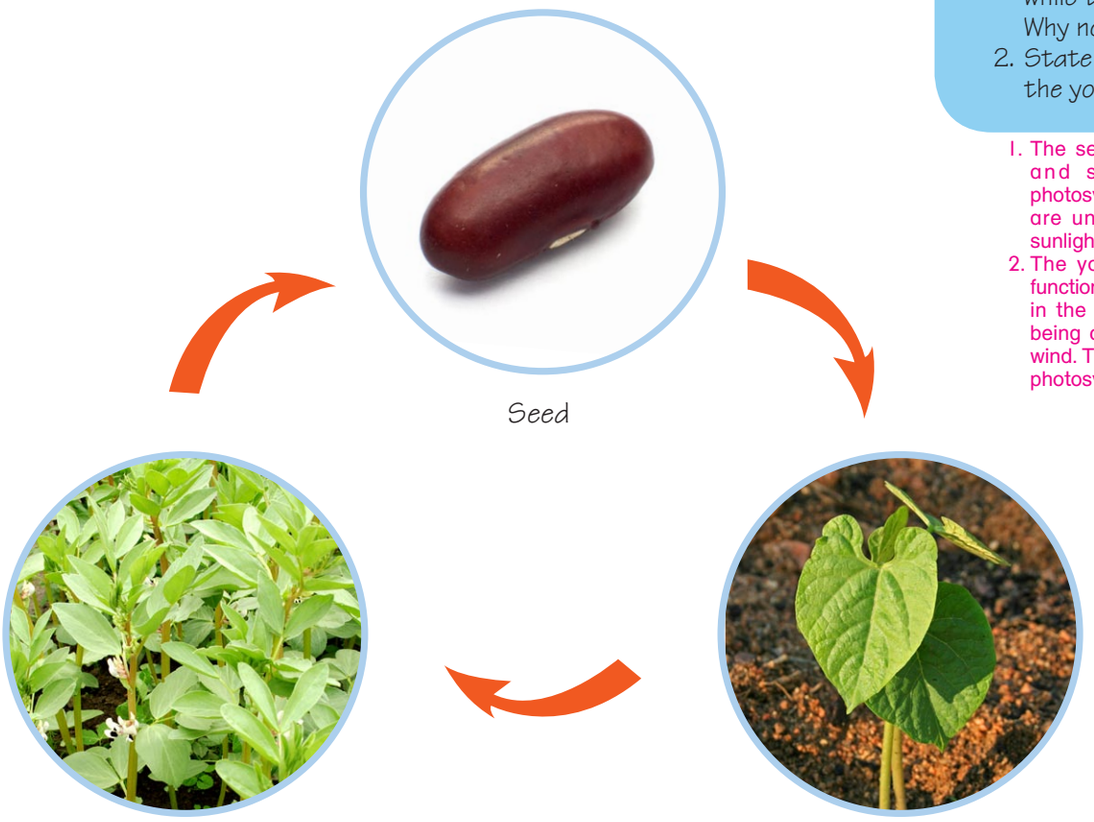
The root is the first part to grow from the seed. The root holds the young plant in the soil.

Next the shoot grows and small leaves appear.

With its leaves, the young plant can now make its own food by photosynthesis. The roots take in the water needed for photosynthesis.

With enough sunlight, water and air, the young plant then develops into an adult plant.

The life cycle of the plant is now complete.



Thinking

1. Seeds cannot use sunlight to get food while they germinate. Why not?
2. State two functions of the young root.

1. The seeds do not have leaves and so cannot carry out photosynthesis. Also, the seeds are under the soil away from sunlight.
2. The young root has two main functions: To hold the young plant in the soil and prevent it from being carried away by water or wind. To absorb water needed for photosynthesis.

WB ★ Activity 3

Reproduction without seeds

Some flowering plants can also reproduce without the need to produce seeds.

New plants grow from parts of a plant such as the roots, leaves and stems.

This reproduction is **asexual reproduction** as male and female sex cells are not needed.

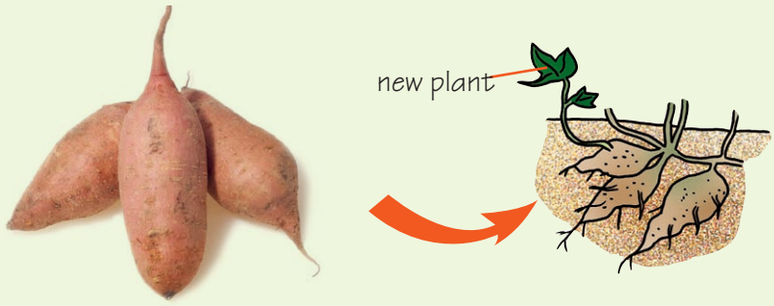
With this method, the new plants are exactly the same as the original plant.

At this level, pupils only need to understand the concept rather than going into great detail. So, only a few types are discussed – enough to give pupils a good understanding of the concept.

Here are some examples.

From roots

Sweet potatoes and carrots can reproduce by growing from **roots**.



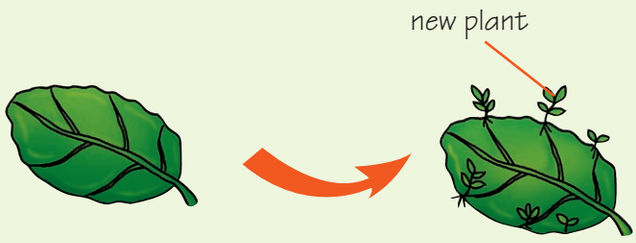
Sweet potato

Carrot

P4.58

From leaves

Bryophyllum can reproduce by growing from **leaves**.



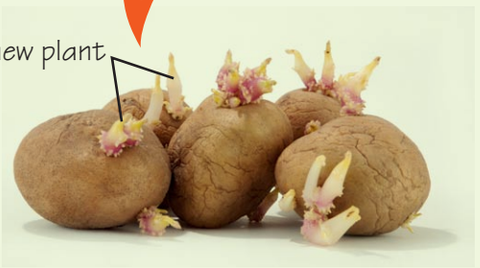
leaf from plant

P4.59

From stems

Potatoes, onions, ginger, yams and bananas can reproduce by growing from **underground stems**.

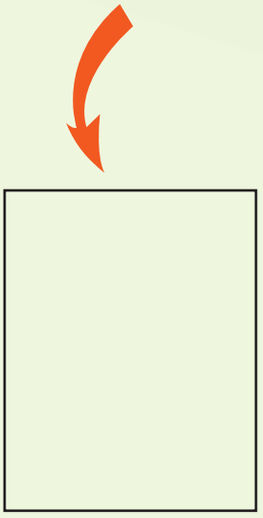
Potato

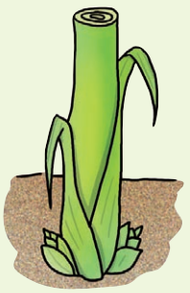


Onion

Yam

Ginger





Banana

Thinking

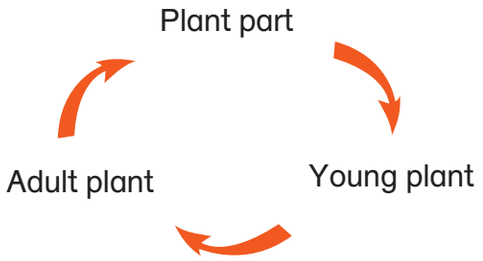
1. How does the life cycle of ginger plant differ from the life cycle of plants that reproduce using sexual reproduction?
2. A young plant that grows from a part of a plant is not called a seedling. Why not?

1. The life cycle does not include seeds.
2. A seedling is a young plant that grows from a seed.

WB ★ Activity 4

Life cycles

The life cycle of these flowering plants is:

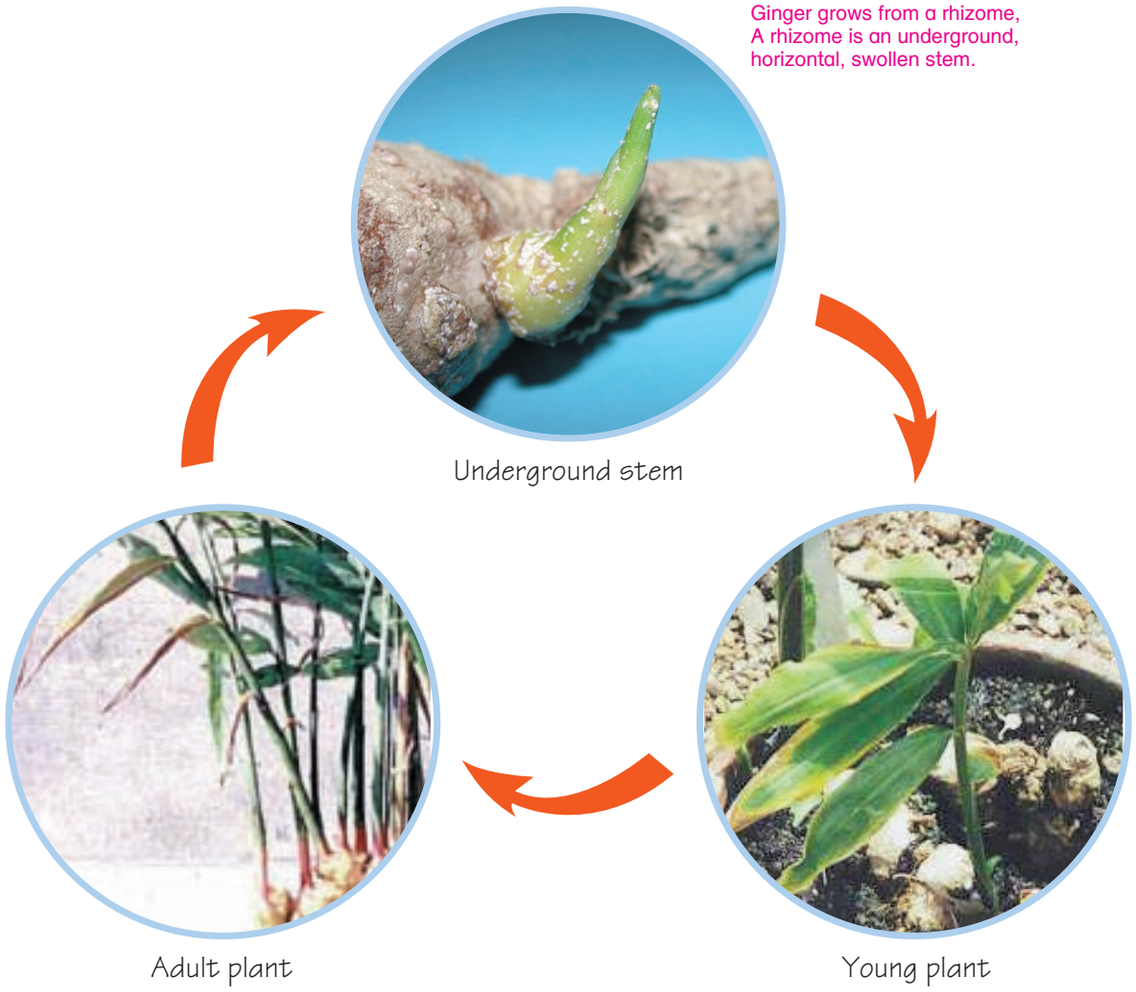


The diagram below shows the life cycle of ginger.

Ginger grows from an underground stem.

The stem is placed in soil. From the stem, new roots appear and a new plant grows.

Ginger grows from a rhizome,
A rhizome is an underground,
horizontal, swollen stem.



Artificial reproduction

People can also grow new plants artificially from parts of a plant. This is widely used in agriculture to grow fruit trees. Two methods used are **cutting** and **marcotting**.

Cutting

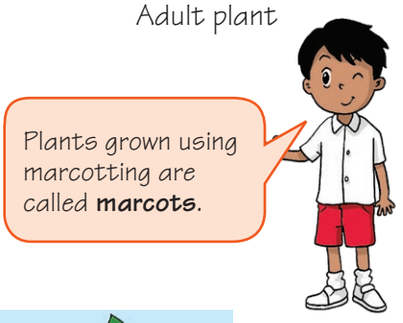
A stem or a leaf is cut off an adult plant and placed in soil. The cut part grows roots and grows into a new plant. Bryophyllum grows from the leaves of a plant.

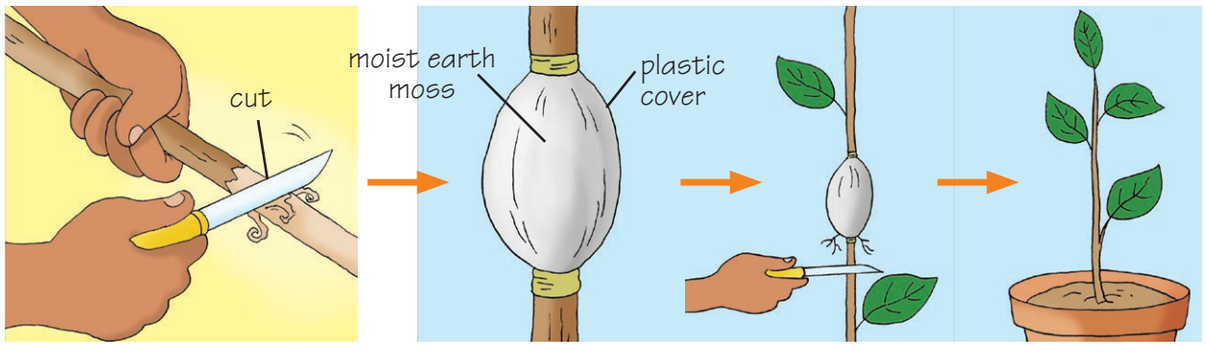
The leaves are cut from the adult plant and placed in water or good soil. New roots appear and a new plant grows.

Leaf in Soil | Young plant | Adult plant

Marcotting

A cut is made around the stem or branch of a plant. The cut is covered with moist earth or moss and plastic. Slowly, roots develop. The stem or branch is then cut off the plant and planted in soil. It grows into a new plant.





Many fruits and plants with beautiful flowers are grown using marcotting. Examples are guava, starfruit, durian, hibiscus, roses, flame of the forest and roses.

Advantages of asexual reproduction

Plants that reproduce without seeds have advantages.

- It is an easy way to grow new plants.
- It is faster than sexual reproduction with seeds.
- It does not need birds, insects or wind (as there is no pollination).
- The new plants are exactly the same as the original plant. So, if a farmer has a fruit tree that grows good fruit, he can use these methods to grow identical fruit trees.

WB ★ Activity 5 & 6

My Conclusions

1. Flowering plants can reproduce from seeds; this is sexual reproduction. Some flowering plants reproduce without seeds; this is asexual reproduction.
2. Flowers are the reproductive parts of a plant. Most flowers have male and female parts.
3. The male parts of a flower are the anther and filament. The anther contains pollen. Inside each pollen grain is a male sex cell.
4. The female parts are the stigma, style and ovary. Inside the ovary are ovules. Each ovule contains a female sex cell.
5. Sexual reproduction involves pollination, fertilisation, formation of fruits and seeds, dispersal of seeds, and germination.
6. Pollination occurs when pollen grains are transferred from an anther to a stigma. Pollination takes place with the help of birds, insects and the wind.
7. The male sex cells fertilise female sex cells in the ovules. The fertilised ovules become seeds. The ovary becomes a fruit.
8. Plants disperse their seeds by wind, water, animals and explosive action.
9. Seeds germinate to form new plants.
10. With asexual reproduction, new plants grow from other plant parts, such as roots, leaves, and underground stems. Artificial methods of asexual reproduction include use of cuttings and marcotting.

WB ★ Activity 7 & 8

STRETCH YOURSELF

1. Losing bees

Bees are important. Without bees, humans would not be able to survive. Because of human activities, the numbers of bees in many countries are decreasing.

(a) Give some reasons why bees are so important.

(b) Find out what human activities are causing the loss of bees.

(a) Bees are the most common pollinators. If we lose the bees, we lose the plants, and if we lose the plants, we lose our food and other animals lose their food. Life will cease.
(b) The biggest threat is habitat loss and destruction, as natural areas are developed for housing and cities. Pesticide use is also killing bees and other pollinators. Climate change is also affecting bee populations.

2. Why plants need to disperse seeds

Find out what happens to plants that grow in overcrowded conditions.

(a) Use two jars or cups of the same size and fill them with soil.

(b) Put two or three tomato seeds in one jar and 20 to 30 tomato seeds in the other jar.

(c) Water the soil every day. Observe how the seeds grow.

(d) Record your observations. From the results, give reasons why plants need to disperse their seeds.

Seeds that have more space to grow produce young plants that have thicker stems and larger, broader leaves to get plenty of sunlight. Seeds that are close together often produce plants that are small, tall and thin due to competition for water and minerals in the soil.

3. Experiments on germination

Plan and carry out experiments to answer the following questions. Remember to have fair tests.

(a) Is light necessary for seeds to germinate?

(b) Is warmth necessary for seeds to germinate?

The experiments will be similar to Activity 3. Note that the experiment only investigates germination, i.e. the first stage of development from the seed to the appearance of the young leaves.
(a) Place equal numbers of seeds (e.g. five) on damp cotton wool in two jars with equal amounts of water on the cotton wool. Place one jar in sunlight and the other in a dark place, such as a cupboard. Both sets of seeds should germinate showing that light is not necessary for germination.
(b) As in (a) but place one jar in a warm place, e.g. the classroom, and the other in a cold place, e.g. a refrigerator. Only the seeds in the warm place will germinate. As light is not needed for germination (from (a)), the first jar could be placed in warm sunlight.
Discuss with pupils the need for fair tests and the control of variables in these experiments.

New words

pollination	pollen	ovule	pollen tube
dispersal	germination	cutting	marcotting