

Sexual reproduction in plants

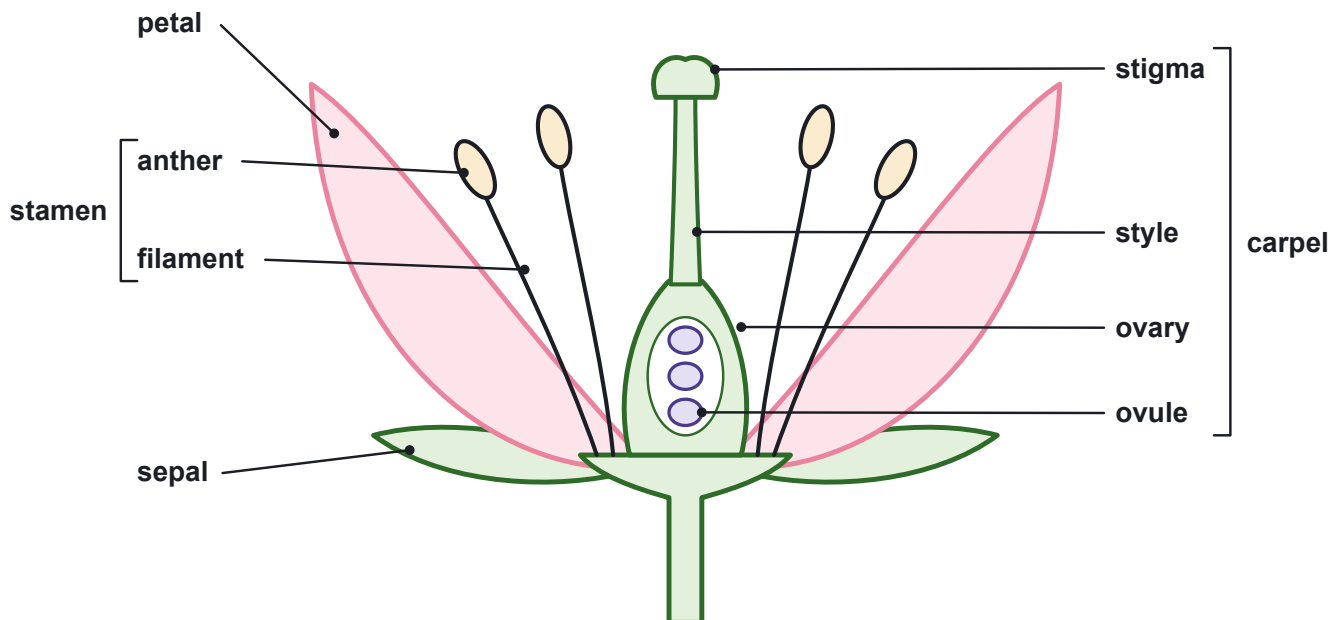
Revision notes • Flower structure and function, insect and wind pollination, pollination and fertilisation, self and cross-pollination, and germination.

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

Sexual reproduction in plants Spec 16.3

Structure of an insect-pollinated flower Spec 16.3.1, 16.3.2

You must be able to identify, and draw, the parts of an insect-pollinated flower, and state what each part does. The **stamen** is the male part and the **carpel** is the female part.



Half-flower of an insect-pollinated flower. The **stamen** (anther and filament) is the male part; the **carpel** (stigma, style, ovary and ovules) is the female part.

Parts of an insect-pollinated flower and their functions

Part	Function
Sepal	Protects the flower in the bud
Petal	Brightly coloured, to attract insects
Stamen	Male part of the flower; made of an anther and a filament
Anther	Produces pollen grains, which contain the male gametes
Filament	Holds the anther up
Carpel	Female part of the flower; made of the stigma, style, ovary and ovules
Stigma	Receives pollen grains; often sticky so that pollen grains stay on it
Style	Holds up the stigma
Ovary	Contains the ovules
Ovule	Contains the female gamete (egg cell); after fertilisation it develops into a seed

Common mistake: The anther makes the pollen. The stigma only receives it. Do not mix up the stamen (male) and the carpel (female).

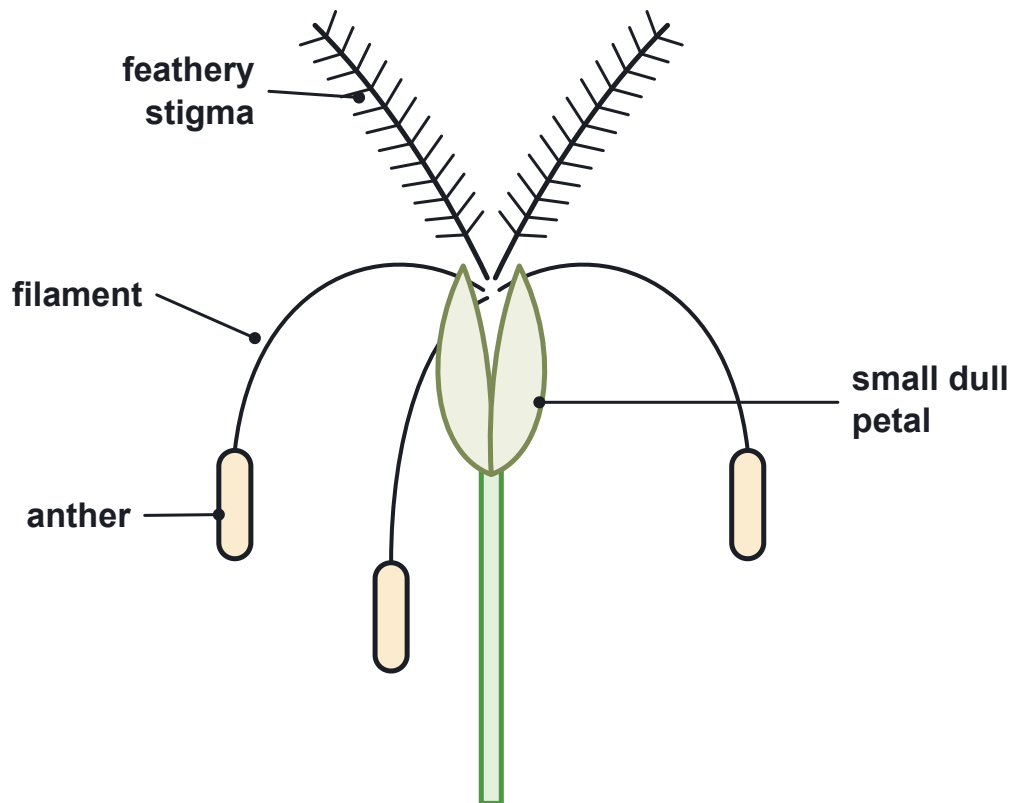
Practical skill: When you draw a flower, use a sharp pencil and a single clear line. Draw it large, do not shade, and label with straight lines that do not cross. Label every part in the list above.

Insect- and wind-pollinated flowers Spec 16.3.3, 16.3.4, 16.3.7

Flowers are adapted to be pollinated either by insects or by wind. Their structures differ in ways you can see and describe.

Wind-pollinated flowers

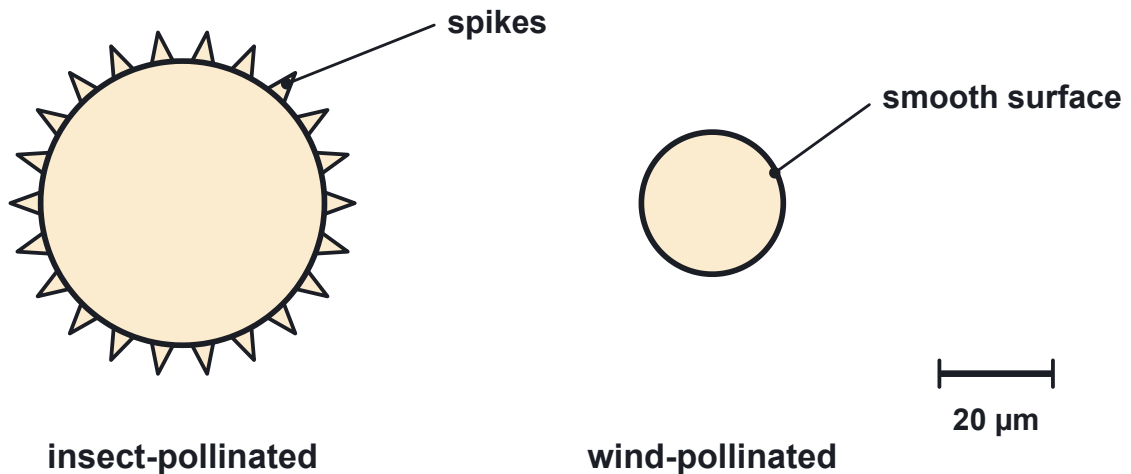
In a wind-pollinated flower, such as a grass, the **anthers** hang outside the flower on long filaments, where the wind can blow the pollen away. The **stigmas** are large and feathery and also hang outside the flower, to catch pollen grains carried in the air.



A wind-pollinated grass flower: **anthers hang outside** on long filaments and the **feathery stigmas** catch pollen from the air.

Pollen grains

Pollen grains of insect-pollinated and wind-pollinated flowers		
	Insect-pollinated	Wind-pollinated
Size and mass	Larger and heavier	Small and light, so they are carried easily by the wind
Surface	Sticky or with spikes or hooks, so they stick to insects	Smooth and not sticky, so they separate easily and are blown away by the wind
Number made	Fewer	Very large numbers, because most pollen does not reach another flower



Insect-pollinated pollen is larger with a spiky surface; wind-pollinated pollen is small, smooth and light.

Adaptations of the flowers

Structural adaptations of insect-pollinated and wind-pollinated flowers		
Feature	Insect-pollinated flower	Wind-pollinated flower
Petals	Large, brightly coloured, often scented, to attract insects	Small, dull, green or absent; there is no need to attract insects
Nectar	Produced, as food for insects	Not produced
Anthers	Inside the flower, positioned so that insects brush against them	Hanging outside the flower, so the wind blows the pollen away
Stigma	Inside the flower, small and sticky, positioned so insects brush against it	Large and feathery, hanging outside the flower, to catch pollen from the air

Exam tip: Always link a feature to its job. 'Feathery stigma' scores less than 'feathery stigma gives a large surface area to catch pollen from the wind'.

Pollination and fertilisation Spec 16.3.5, 16.3.6, 16.3.12

Pollination is the transfer of pollen grains from an anther to a stigma. Pollination is not the same as fertilisation. Pollen has to reach the stigma first, then fertilisation can happen.

Fertilisation occurs when a pollen nucleus fuses with a nucleus in an ovule.

Pollination	The transfer of pollen grains from an anther to a stigma.
Fertilisation (in plants)	The fusion of a pollen nucleus with a nucleus in an ovule.

Supplement

The pollen tube

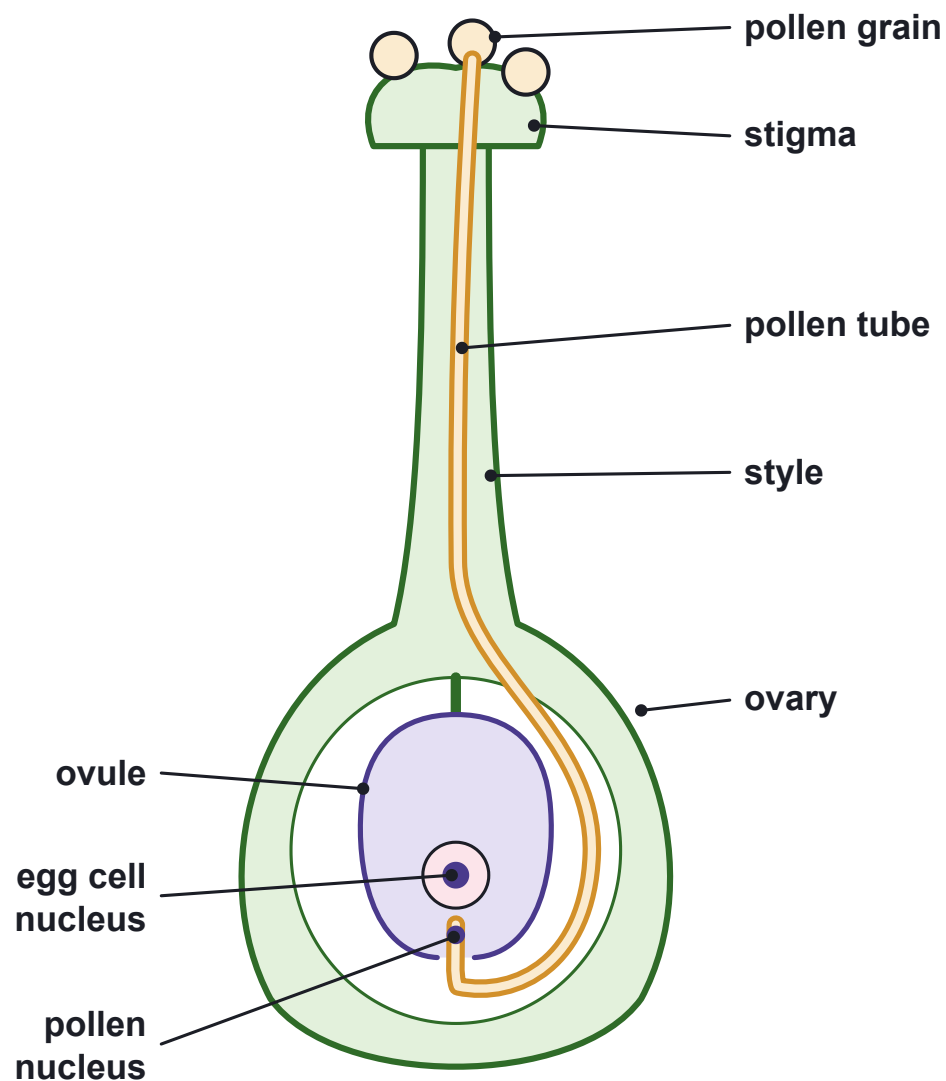
Supplement

1. A pollen grain lands on the stigma of a flower of the same species.
2. A pollen tube grows out of the pollen grain and down through the style.
3. The pollen tube grows towards the ovary and enters an ovule.
4. The nucleus of the pollen grain (the male gamete) passes down the tube into the ovule.
5. The pollen nucleus fuses with the nucleus of the egg cell in the ovule. This is fertilisation, and it forms a zygote.

Supplement

You do not need to know how the endosperm is made or how the seed and fruit develop.

Supplement



The **pollen tube** grows down the style and into an ovule. The **pollen nucleus fuses with the egg cell nucleus**: this is fertilisation.

Common mistake: Pollination and fertilisation are different. Pollination is the transfer of pollen to the stigma. Fertilisation is the fusion of nuclei.

Self-pollination and cross-pollination Spec 16.3.9, 16.3.10, 16.3.11 Supplement

Self-pollination	The transfer of pollen grains from the anther of a flower to the stigma of the same flower or a different flower on the same plant.
Cross-pollination	The transfer of pollen grains from the anther of a flower to the stigma of a flower on a different plant of the same species.

In **self-pollination** only one plant is involved. In **cross-pollination** two plants of the same species are involved, so the offspring have genetic information from two different parents and show more **variation**.

Effects on a population

Self-pollination and cross-pollination compared		
	Self-pollination	Cross-pollination
Variation	Less variation in the offspring, because the genetic information comes from one parent plant	More variation in the offspring, because genetic information is mixed from two different plants
Capacity to respond to changes in the environment	Less able to respond. The offspring are similar, so a change such as a new disease may affect all of them. Fewer individuals may survive.	Better able to respond. Some varied offspring may be suited to the new conditions, survive and reproduce, so the population is more likely to survive.
Reliance on pollinators	Less reliant on pollinators: pollen only has to reach a stigma on the same plant (often in the same flower), so seeds can still be made if pollinators are scarce	Relies on pollinators such as insects, or on the wind, to carry pollen to a different plant. If pollinators are scarce, fewer seeds may be made.

Exam tip: 'Discuss' questions need a benefit and a drawback each time. Link each to variation, to ability to cope with a changing environment, or to reliance on pollinators.

Germination Spec 16.3.8

Germination is when a seed begins to grow into a new plant. A seed needs three conditions to germinate: **water**, **oxygen** and a **suitable temperature**. Light is not needed for most seeds to germinate.

Why seeds need these conditions	
Condition	Why it is needed
Water	The seed absorbs water and swells, and its enzymes become active. The enzymes break down the stored food so it can be used for growth.
Oxygen	Needed for aerobic respiration, which releases energy for growth
Suitable temperature	Enzymes work best at a suitable temperature. Too cold and reactions are too slow; too hot and enzymes are denatured.

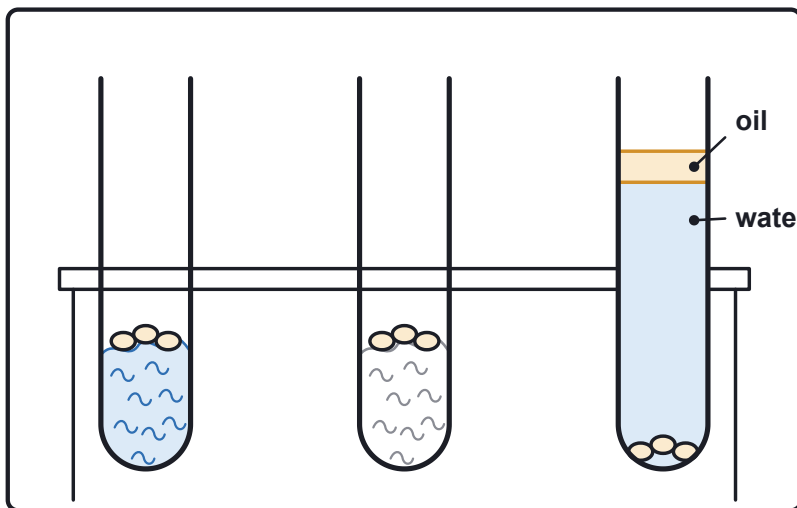
Investigating the conditions needed for germination

Set up several tubes with the same number of seeds and change one condition at a time. Tube A has all three conditions and is the **control**. Keep all the tubes in the dark (a fridge is dark inside), so that light is the same for every tube and is not a confounding variable.

Germination investigation

Tube	Water	Oxygen	Temperature and light	Expected result
A (control)	Damp cotton wool	Air present	20 °C, dark cupboard	Seeds germinate
B	Dry cotton wool	Air present	20 °C, dark cupboard	No germination: no water
C	Seeds covered with boiled, cooled water and a layer of oil	Little or none: boiling removes dissolved oxygen, and the oil stops air entering	20 °C, dark cupboard	No germination: no oxygen
D	Damp cotton wool	Air present	Fridge, about 4 °C (dark)	No germination: too cold

dark cupboard at 20 °C

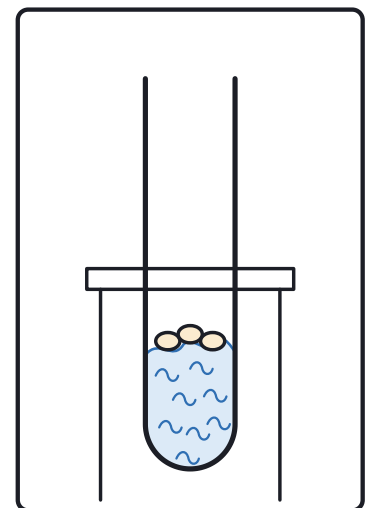


A (control)
damp cotton wool
seeds germinate

B
dry cotton wool
no water

C
boiled, cooled water
with oil on top
no oxygen

fridge at about 4 °C (dark)



D
damp cotton wool
too cold

Each tube differs from the **control** (A) in one condition only. Only tube A has water, oxygen and a suitable temperature.

Practical skill: Keep every other variable the same: same type and number of seeds, same volume of water, same light (all in the dark) and same time. Leave the tubes for several days and count the seeds that have germinated in each. Using more seeds per tube makes the result more reliable.

Exam tip: Say what each tube shows by comparing it with the control. Only one condition should differ between the control and each other tube.

Quick check

1. Which part of a flower makes pollen?
2. Define pollination.
3. Give two features of wind-pollinated pollen grains.
4. What three conditions does a seed need to germinate?
5. **Supplement** Define cross-pollination.

Quick check answers

Sexual reproduction in plants

1. The anther.
2. The transfer of pollen grains from an anther to a stigma.
3. Small and light; smooth surface.
4. Water, oxygen and a suitable temperature.
5. The transfer of pollen grains from the anther of a flower to the stigma of a flower on a different plant of the same species.