



# Reproduction in Plants

Biology Topic Pack V for KS3 Science



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# Teachers' Introduction

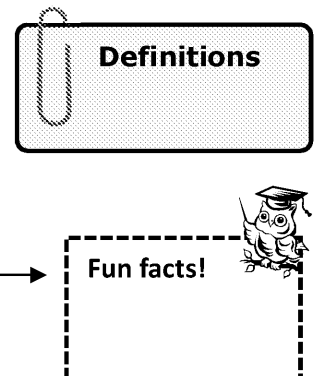
This topic pack covers reproduction in plants, including the context for reproduction in the life cycle of the plant, how plants reproduce to make seeds, how seeds are dispersed, and asexual reproduction in plants. Prior learning about what plants are, where they exist, and why they are important, as covered in Key Stages 1 and 2, would be useful to set the learning into context.

This topic pack is designed for Key Stage 3 and is appropriate for Years 7 and 8. It covers the National Curriculum statement:

**reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.**

The topic pack includes the following components:

- Explanations and examples of the key concepts 
- Key scientific terms and definitions
- Comprehension questions (to be answered in a student's workbook) 
- Fun facts 
- Working scientifically – focus: dissecting, drawing and labelling, and how are seeds spread?
- Crossword
- End-of-topic questions (to be answered in a student's workbook)\*
- Answers

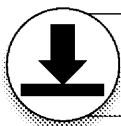


This topic pack covers the material seen in the following two textbooks:

- *Activate 1* (Gardom Hulme et al.): Chapter 3.6–3.8 (pp. 50–55)
- *Exploring Science 9* (Levesley et al.): Chapter RBb (p. 154)

It could be used to support in-class learning and independent study at home, as a workbook for cover lessons or extension work, or to encourage independent or project work. The investigations are suitable for home or school, and could be set as homework for discussion and conclusion in the classroom.

August 2023



\*A write-on version of the end-of-topic questions is provided on the ZigZag Education Support Files system, which can be accessed via [zzed.uk/productsupport](https://zzed.uk/productsupport)

## Learn in context!

Plants belong to a kingdom of organisms which are **autotrophs** and cannot move from place to place. They come in a huge range of shapes and sizes, from the very small duckweed floating on ponds to the absolutely enormous sequoia trees that can live for hundreds of years!

Plants are amazing because they use light energy from the Sun to convert carbon dioxide and water into their own body and food supply in a process called **photosynthesis**. Without plants, life on Earth is unlikely to exist, because plants provide food and shelter for many animals and keep the carbon dioxide and oxygen levels in our atmosphere stable and good for life.



**Autotroph:** an organism which produces its own food, like a plant

**Photosynthesis:** the process in plants whereby they convert carbon dioxide and water into sugar (glucose) and oxygen using light energy

### Fun fact!

All the green parts of a plant can photosynthesise, including the stem!



Q1: Which process in plants allows them to make their own food?

Q2: Copy and complete the word equation for photosynthesis:

Carbon dioxide + \_\_\_\_\_ → Glucose + \_\_\_\_\_

Most plants have some common parts:

- The **roots** gather water and nutrients.
- The **stem** allows food, water, nutrients and waste to be moved around the plant.
- The **leaves** photosynthesise.
- The **flower** allows the plant to **reproduce**.

**Reproduce:** to make more copies of itself

Q3: Through which parts of the plant does water move?

Q4: What do flowers allow the plant to do?

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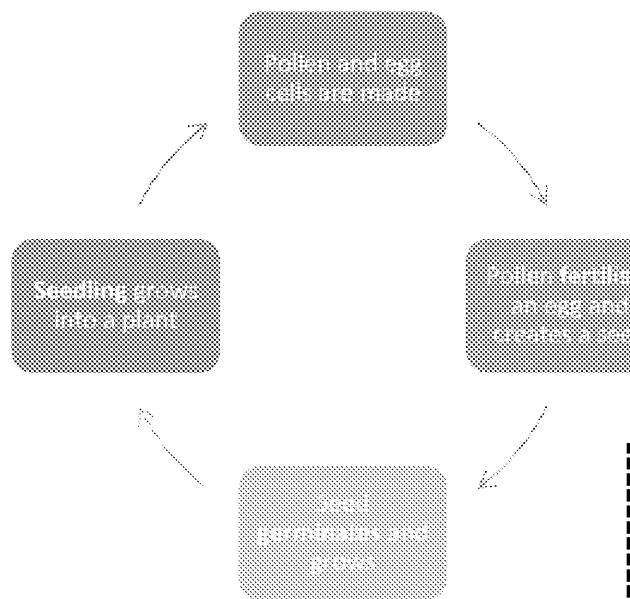
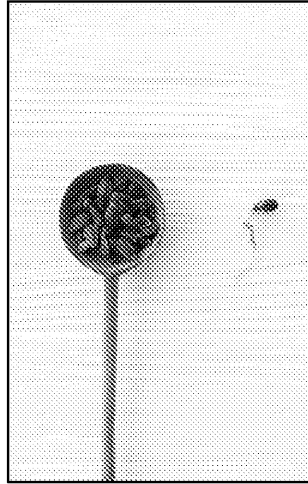
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## Life cycle of a plant

Plants have a life cycle, just like humans. They start off as specialised cells called **eggs** (also known as ova) and **pollen**, and end up as adult plants that can reproduce again.

**Eggs:** the female reproductive cells  
**Pollen:** the male reproductive cells



The adult plant makes pollen (male sex cells) and eggs (female sex cells). After dispersal, the pollen is then able to fuse with the egg cell in a process called fertilisation. The seed can then germinate into a new plant. The seedling continues to grow until it is mature and begins the cycle again.

**Fertilise:** when a male sex cell, pollen (plants) or sperm (animals) fuses with a female sex cell, the egg

**Germinate:** when a seed starts to grow

**Seedling:** the baby plant which is not fully mature and cannot produce its own seeds

**Mature:** fully developed / full-grown

Q5: What is the name of the male sex cell in a plant?

Q6: What is the name given to a baby plant?

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## What is a flower?

A flower contains the reproductive organs of the plant. It contains the male parts and the female parts, which make and store eggs. It also has parts such as bright colours which attract insects.

Flowers attract insects to come to the flower and get their tasty nectar. While doing so, as it brushes past the **anthers**, or transfers pollen onto the sticky **stigma**. This allows seeds to be produced.



**Petal** of the flower  
**Nectar** is the sweet liquid  
**Scene** is the flower  
**Anther** is the male part of the flower  
**Stigma** is the female part of the flower

Q7: Why do plants have flowers?

Q8: How are animals encouraged to visit a plant?

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## Inside a flower

Flowers have three groups of parts:

1. The male reproductive organs.
2. The female reproductive organs.
3. The other parts, such as packaging and advertising.

The male parts of the flower include the anther and the **filament**. The anther is where the pollen is released from, and the filament holds the anther up.

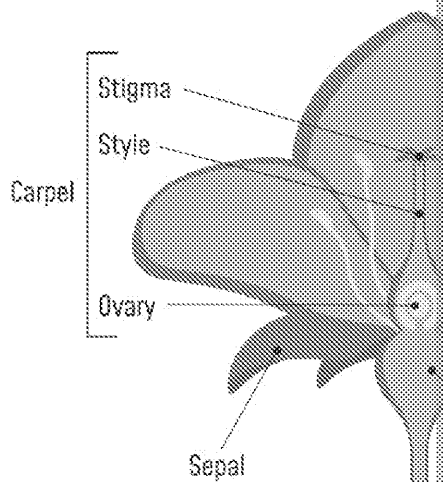
Together, these parts are called the **stamen**.

The female parts of the flower include the **ovary**, the **style** and the **stigma**.

The stigma is sticky and collects pollen, which travels down the style to the ovary, which contains the eggs.

Together, these parts are called the **carpel**.

The **receptacle** holds the flower together and the **sepals** cover the petals when the flower is closed, giving it some protection.



Q9: Use the image and text to copy and complete the table.

Part of flower	Function of
Anther	
	Holds the anther
Stamen	
	Stores the pollen
Style	
	Collects pollen
Carpel	
	Holds the flower
Sepal	
	Attracts animals

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## Types of pollination

**Pollination** happens when pollen is transferred to the stigma of another plant.

Insects, including bees, moths, flies, wasps and butterflies, collect pollen on their bodies as they are hunting around the flower in search of nectar. When they move to another flower, some of the pollen rubs off onto the sticky stigma, pollinating that flower. Plants pollinated in this way are insect-pollinated.



### Fun fact!

Bees and butterflies have a really long tongue called a proboscis, which rolls up when not being used to drink nectar!



Q10: What is pollination?

Q11: List some insects involved in pollination.

However, not all plants have flowers because not all plants use insects to spread their pollen and fertilise their eggs. Some plants, like grasses and willow trees, which produce catkins, use the wind to blow their pollen and transfer it from one plant to another.



*Hare's tail or Bunny tail grass, showing feathery stigma.*



*Knap grass has very long anthers and also has feathery stigma.*

### Fun fact!

Some wind-pollinated trees release clouds of pollen, which is often responsible for hay fever!



Wind-pollinated plants have anthers on very long filaments so they can reach the wind. They also have large, feathery stigmas to catch the pollen as it blows past.

Q12: Why are wind-pollinated plant anthers on very long filaments?

Q13: Why are wind-pollinated plant stigmas large and feathery?

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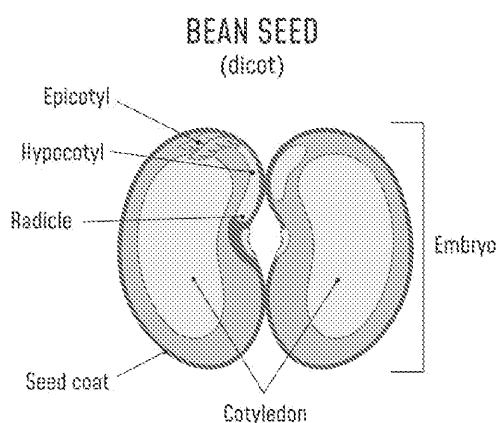




## What are seeds?



**Seeds** (which also include apples or peaches) are the start of a new plant. A seed contains all the genetic material to grow a new plant, and this DNA comes from both parents: the female plant (which provides the egg) and the male plant (which provides the sperm). A seed contains enough energy to create its first leaves and roots, but until it can photosynthesize, it cannot be a good source of food until it can grow. Many animals eat seeds, and some, like birds, can even eat the seeds in our gardens!



**Seed:** the start of a new plant, containing genetic material plus enough energy to produce it.

### Fun fact!

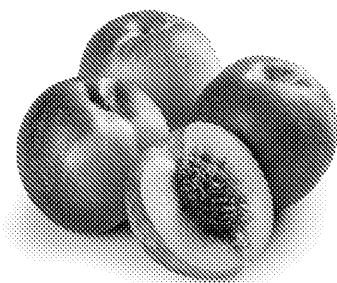
Seeds of the sequoia tree need to pass through a forest fire before they can germinate. They are sometimes called phoenix seeds.

Q14: The DNA in a seed has come from other plants: how many?

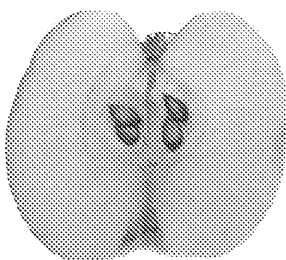
Q15: Why do so many animals eat seeds?

Seeds are wrapped in an external case to protect the contents from the outside world. Some seeds start germinating before the conditions are good enough for them to grow.

Some seeds are wrapped in a really hard case, such as the stones of fruit like peaches, to protect them from being eaten by animals. Other seeds are wrapped in a really tasty layer, which actively encourages animals to eat them! These seeds usually need to pass through a digestive tract (stomach and intestines) to break down the outer layer enough to grow.



Nectarines showing hard stones which protect the seed inside.



Apple pips are seeds of new apple trees.

Kiwi seeds are often found in the soil.

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Q16: Why are some seeds wrapped in really hard cases?

Q17: Why do some seeds need to pass through a digestive tract?

## Spreading seeds about

Plants produce many hundreds of seeds because their chances of survival to being reproduce are very low indeed. This means it is very unlikely that a seed will develop enough to produce its own seeds, so plants make hundreds of seeds in the hope to survive until they can reproduce.

**Disperse:** to spread about

Plants compete with each other for many resources such as nutrients and space. If all the hundreds of seeds that a plant produces germinate and try to grow at the foot of the parent plant, they will compete for the same resources and only a few would survive. To overcome this, plants have developed many clever ways of **disperse** their seeds.

Q18: Name three things that plants compete for.

Some seeds have parachutes or sails attached which allow them to travel miles in the wind, such as dandelions. Others have helicopter-like blades which carry them slowly to earth and away from their parent, such as sycamore trees. Others are wrapped in juicy, tasty fruit and need to be eaten by an animal which moves away from where the fruit was found and defecates (poos) the seeds out far from the original plant, in a lovely pile of fertiliser too! Other seeds have hooks or barbs attached which attach to animal fur and are carried far away before they are dropped.

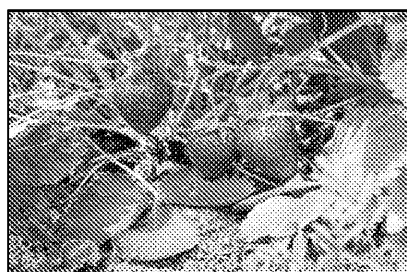
Fun Fact: The Great Burdock as



*Dandelion seeds have parachutes attached, allowing them to travel for miles.*



*Maple tree seeds have large helicopter-like blades attached, which allow them to fall to earth slowly and away from the parent tree.*



*The surface of a strawberry is covered with many seeds!*



*The burdock seed uses tiny hooks on the end of spikes to attach to animal fur and be transported far away from the parent plant.*

Fun Fact: Fruit ins are go

Q19: List two ways seeds are dispersed.

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## Reproducing without seeds

Producing seeds takes time and energy, and requires two parents. It is a form of **sexual reproduction**. Some plants have found ways of making new plants without the need for another plant of the same species. These plants can **reproduce asexually**. This is much faster and requires less energy, as seeds are not produced. However, the **offspring** are **clones** of the parent, so if the parent has any unusual **mutations**, then the offspring will have them too.

**Sexual reproduction** which involves two parents.  
**Asexual reproduction** which involves one parent.  
**Offspring:** the baby of the parents.  
**Clone:** one organism with the same DNA as its parent.  
**Mutation:** a change in the DNA which can have positive or negative results.

Q20: What type of reproduction involves the production of clones?

Q21: Why is this form of reproduction used by plants?

Many plants can reproduce asexually, but have the choice of doing so or producing seeds. For instance, spider plants often produce clones and for strawberry plants send out runners to make a clone while also producing strawberries.

Q22: What is the name given to the clone of a strawberry plant?



*A spider plant with clones hanging off.*



*A strawberry plant runner.*

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## Working scientifically – dissecting, drawing and labelling

One of the skills of a biologist is to be able to make scientific drawings of objects showing the important features of the specimen. Examples of old botanical drawings from the 18th century show specimens in immense detail, drawn by talented artists. However, a good scientist should follow these guidelines:

- show outlines only, with no shading or sketching
- include label lines drawn with a ruler, without arrow heads, and no lines crossing
- be labelled with magnification or relative size scale included

In this task, we are going to carefully dissect a flower to separate its parts, then create a scientific approach.

### Dissection

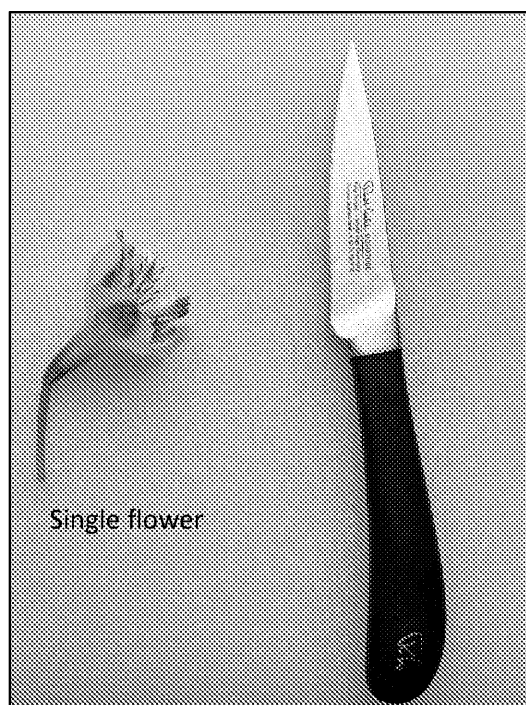
**Dissection** is the careful cutting up of a specimen to reveal its inner parts. We are using this example, an *Alstroemeria* has been used as it has very visible male and female parts to obtain. However, a lily, a daffodil or another flower which has visible and large parts would be as easy to dissect.

**Apparatus:** sharp knife or scalpel, cutting board. You may also use a hand lens to observe.

**Safety:** Keep your fingers safely out of the way of the sharp blade.

### Method

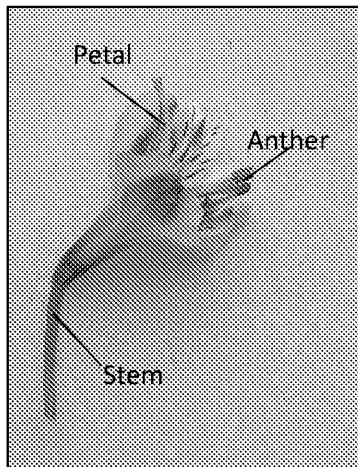
1. Using a sharp knife, carefully remove one complete flower from the *Alstroemeria*. Lay it on the cutting board.



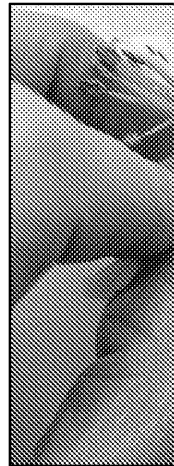
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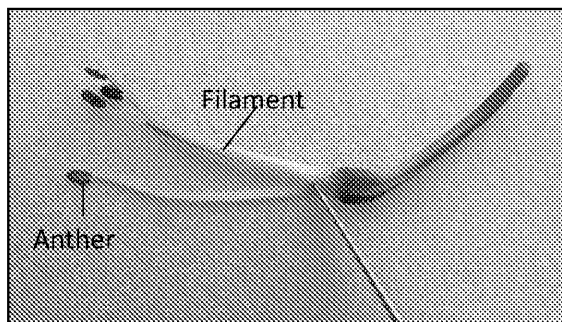
- Look carefully at the flower and identify the different parts.



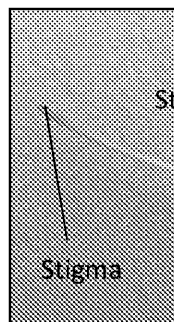
- Remove the petals by cutting each petal away from the stem through the stalk on your cutting.



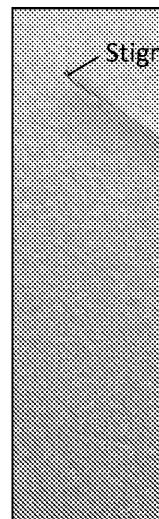
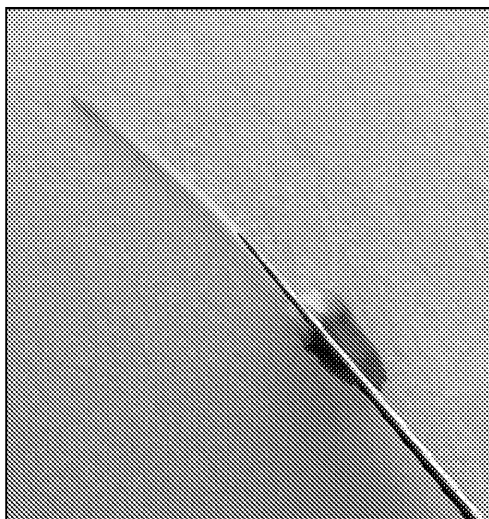
- Remove the stamens individually and arrange them neatly. Be careful as the anthers may detach from the filaments quite easily. These are the male parts of the flower.



- Remove the extra parts of the flower.



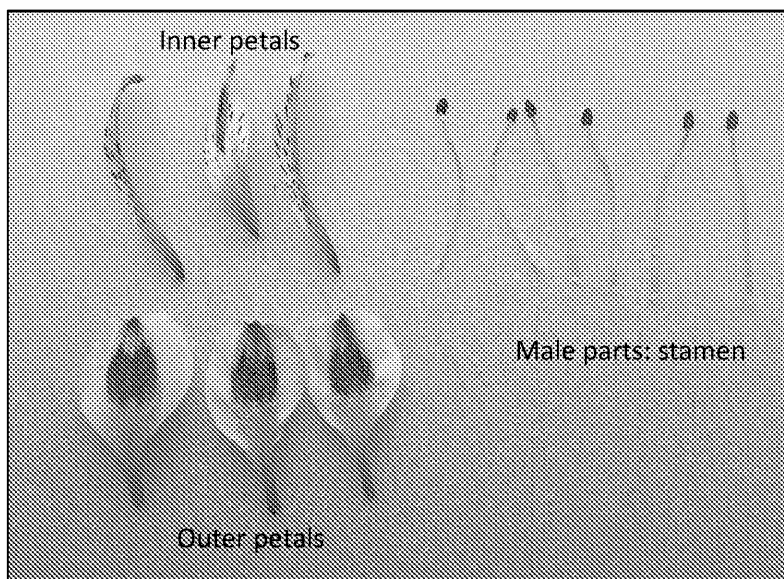
- Cut the ovary in half lengthways to reveal the eggs within.



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7. Arrange the parts of the flower neatly on the cutting board, photograph

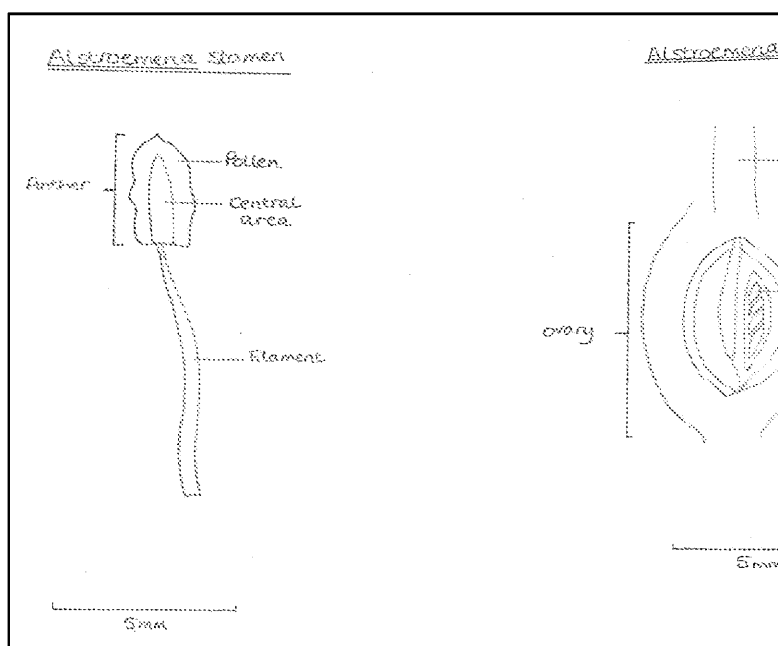


## Drawing

To make a biological drawing, choose one or more sections of the flower, and observe with a hand lens if available. Use a sharp pencil and take your time.

### Drawing success factors

- ✓ Single lines, no feathering
- ✓ Outlines drawn only
- ✓ No shading (hatching is allowed if necessary)
- ✓ Label lines drawn with ruler
- ✓ Labels
- ✓ Scale bar
- ✓ Title including specimen name



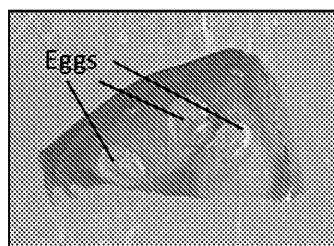
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## Evaluation

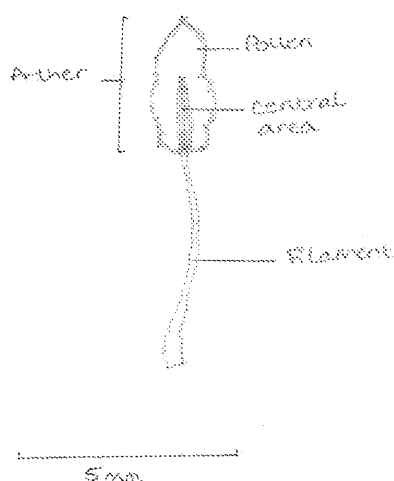
- Review your dissection against the example photograph, and your drawing against the example, and reflect upon what you have done well and how you might improve.
- Dissect a different flower and compare the similarities and differences.
- Dissect a flower after it has been fertilised – is there any noticeable difference?



*Eggs in a dissected tulip  
Notice how these are very  
developing into seeds  
distributed and grow in*

Q23: Look carefully at the two example drawings and identify the mistakes.

Alstroemeria Stamen



Alstroemeria



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## Working scientifically – how are seeds spread?

How do plants spread their seeds far and wide? Some use animals to help them, alone! In this investigation, you are going to test some different helicopter-like blades to see which are most effective at travelling.

### Aim

To create a number of different-shaped blades and test them to see which goes furthest.

### Method

1. Create your blade. Use a piece of A4 paper and cut it in half lengthways (long way). You will need a long, thin piece of paper. From one of the short ends, cut in so that the paper is 2cm wide, then fold each blade back in opposite directions to create a helicopter-like shape.
2. Drop the helicopter from a height; for instance, over the banister of a staircase. Always have an adult present.
3. Record how far it travels horizontally away from where you dropped it: the distance from sky to ground.
4. Repeat the drop at least three times and calculate the **mean** distance.
5. Then repeat steps 1 to 4 again with a different-shaped blade, being as inventive as you can.

**Mean:** to calculate the mean, add the distances together and divide by the number of measures you added. For instance, if you had three distances, of 3, 4 and 5, you would add them up ( $3 + 4 + 5 = 12$ ) then divide by 3 (because there are three values), giving a mean distance of 4.

### Results

Record your results in a table such as the one below.

Blade	Distance travelled (m)		
	1	2	3
Shape 1			
Shape 2			
Shape 3			

### Conclusion

- Which blade went the furthest and is, therefore, the best for dispersing the seeds?
- How did this blade differ from the other blades?
- How could you improve the blade to make it travel further?
- Are there any seeds that look like this in real life?

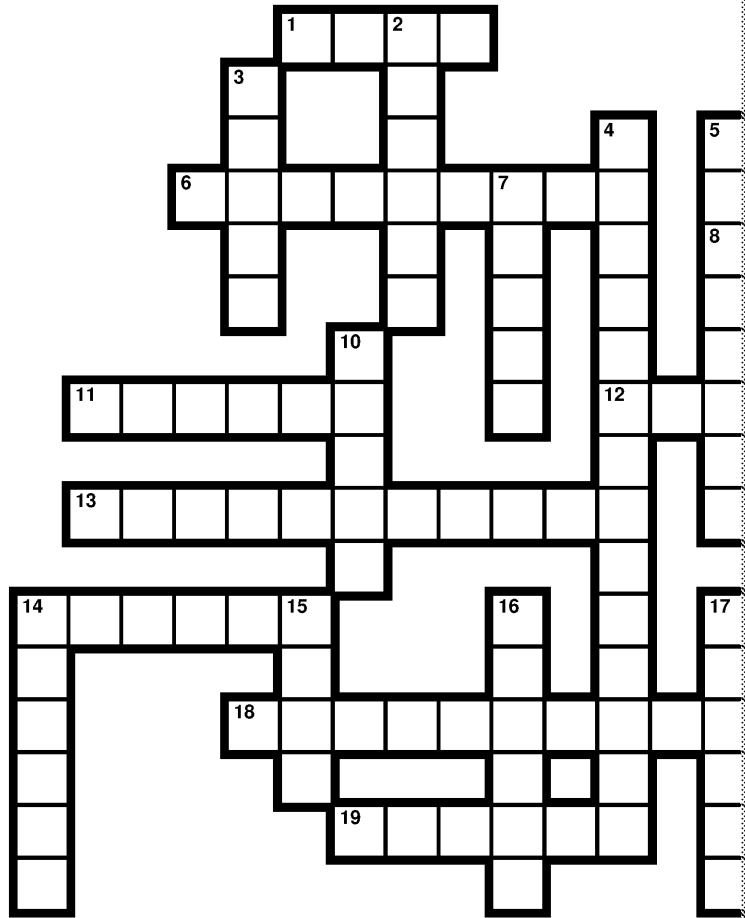
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## Crossword



### Across

- 1 A type of pollination which does not require an animal (4)
- 6 An organism which produces its own food, like a plant (9)
- 8 The female reproductive cell (3)
- 11 A form of reproduction which requires two parents (6)
- 12 The sticky part of a flower which collects pollen (6)
- 13 The movement of pollen from one plant to another (11)
- 14 Brightly coloured parts of the flower (6)
- 18 When the female and male sex cells fuse (13)
- 19 Occurs to the fruit at the same time as the seed matures (6)

### Down

- 2 Sugary solution which contains a lot of energy (6)
- 3 Soft flesh surrounding the ovary which encourages animals to eat it (5)
- 4 The process in plants which uses light energy to produce food (3)
- 5 A plant which has just started to grow from a seed (5)
- 7 The part of a flower which produces pollen (4)
- 9 When a seed starts to grow (5)
- 10 One organism which produces offspring as its parent (5)
- 14 Organisms which can live without an important part of the body (5)
- 15 Produced when an egg is fertilised (5)
- 16 The male reproductive cell (4)
- 17 The part of a flower which produces pollen (4)

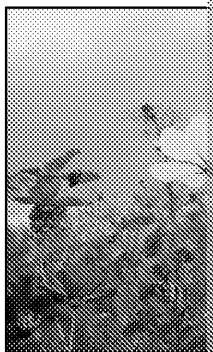
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## End-of-topic Questions

1. All plants produce flowers: true or false?
2. List **three** things plants compete for.
3. State the word equation for photosynthesis.
4. Reproduction with two parents is known as asexual reproduction: true or false?
5. Name the parts of the female section of a flower.
6. Define the term 'dispersal'.
7. Suggest an advantage to having seeds dispersed by fruit.
8. Wind-pollinated plants require petals: true or false?
9. Draw the life cycle of a plant.
10. Name **two** types of pollination.
11. List **two** success factors for good biological drawings.
12. Explain why seeds must contain a food source for the infant plant.
13. Suggest why some apple trees need to be planted in pairs.
14. Suggest an advantage of having two parents rather than being a clone.
15. The flowers of the snapdragon (*Antirrhinum majus sp.*) are large and heavy in order for a pollinator to access the nectar and pollen. Suggest which insects pollinate these flowers and why.
16. Some flower varieties developed by professional plant growers have 'double' layers of petals. These are very attractive but not very good for supporting pollination. Suggest why.
17. Suggest a hazard associated with dissection and a precaution you can take to avoid it.
18. The corpse lily is a very specialised plant, whose flowers have evolved to look like a dead animal. Suggest which insects might pollinate this flower and explain why.
19. If a plant produces 1000 seeds and only 1 % of these germinate into new plants, how many seeds must the plant produce? Show your workings.
20. If 30 % of these seedlings are damaged before they can reproduce, how many seeds must the plant produce to ensure 1000 survive to adulthood? Show your workings.
21. Suggest why water is necessary to make seeds germinate.
22. If there is a dry, hot spell of weather in the summer, gardeners often find that some plants quickly produce seeds, which makes the plant taste bitter and the gardeners know why this occurs.



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# Answers

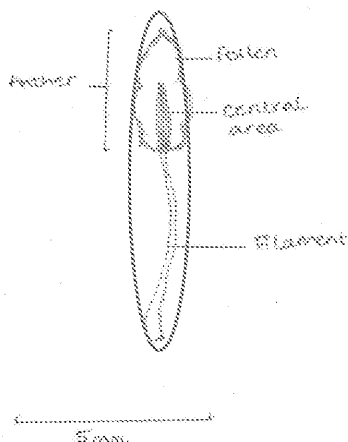
## Comprehension questions

1. Photosynthesis
2. Water, oxygen
3. Roots, stem, leaves
4. Reproduce
5. Pollen
6. Seedling
7. To attract insects (to the reproductive organs)
8. Bright petals, sweet nectar, scent
- 9.

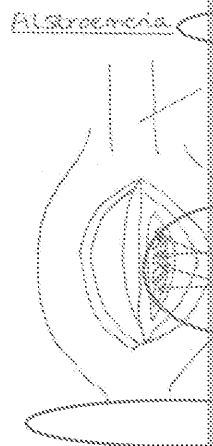
Part of flower	Function of part
Anther	Releases pollen
Filament	Holds the anther up
Stamen	The anther and the filament
Ovary	Stores the eggs
Style	Where the pollen travels down
Stigma	Collects pollen
Carpel	The ovary, style and stigma
Receptacle	Holds the flower together
Sepal	Covers the petals
Petals	Attracts animals

10. Transfer of pollen to stigma of another plant
11. Bees, moths, flies, wasps, butterflies
12. Blow in wind to release pollen
13. Catch wind-blown pollen
14. Two
15. Good source of energy
16. To stop them from being eaten
17. Break down the outer layer to allow germination
18. Water, light, nutrients and space
19. Parachutes/sails, helicopter-like blades, fruit, hooks/barbs
20. Asexual
21. It is faster, uses less energy and requires only one parent
22. A runner
23. Feathering and shading in whole drawing

Astroemeria Stamen



Incomplete title. Label arrow heads and cross

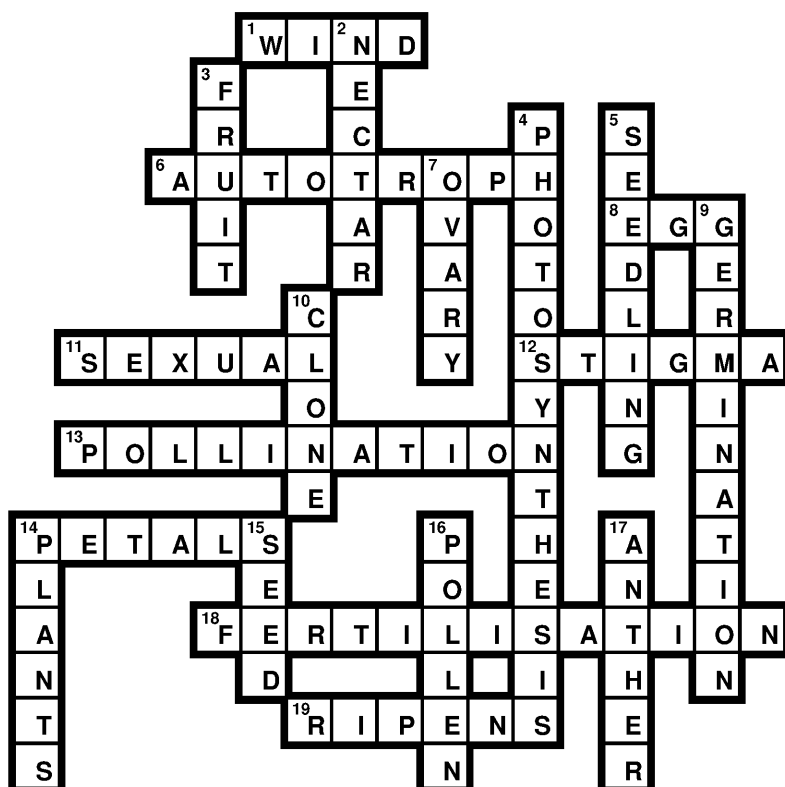


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## Crossword



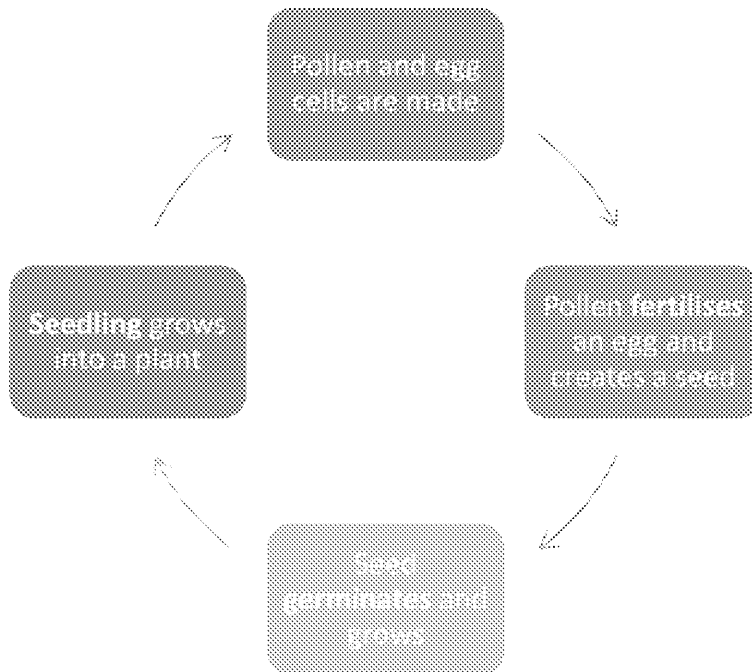
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## End-of-topic questions

- False
- Water, light, nutrients and space, but could also include reproduction/pollen, pollination
- Water + Carbon dioxide  $\rightarrow$  Glucose + Oxygen
- False
- Ovary, style and stigma, collectively called the carpel
- To spread about
- Seeds are carried far away from parent plant by animal which eats it / Seeds are produced and deposited in fertiliser when ready to germinate
- False
- 



- Insect, wind (also mammal, bird)
- Single lines, no feathering; Outlines drawn only; No shading (hatching is allowed if no ruler; Labels; Scale bar; Title including specimen name
- The seed cannot photosynthesise so requires food from another source
- They need each other to pollinate their flowers to produce fruit and seeds
- Less likely to have unusual genetic mutations / Increases chance of survival
- Bees, because they are large and strong enough to open the petals
- Pollinators cannot reach the nectar and pollen because of the number of petals
- Sharp blade: keep pointed away / don't run with it / use with supervision, or other safety equipment  
Allergy to pollen: if allergic, wear a face mask / take antihistamines / avoid flowers where possible / by rinsing in water, or other sensible suggestion
- Flies, because they lay their eggs in dead animal meat
- $1000 / 100 \times 1 = 10$  **OR**  
 $1000 \times 1\% = 10$  **OR**  
 $1000 \times 0.01 = 10$
- $10 / 100 \times 70 = 7$  **OR**  
 $10 \times 70\% = 7$  **OR**  
 $10 \times 0.7 = 7$   
*Allow error carried forward from previous question.*
- Water is important for plants to survive. If there is no water, then the seedling is unlikely to survive
- Hot, dry conditions cause drought. The lack of water makes it more likely that the plant will die quickly, reproducing before it dies.

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