

## 16.3.1 Flower structure, pollination, fertilisation and germination

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Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 34 marks

**KEY WORDS** pollination 传粉 • seed 种子 • stigma 柱头 • anther 花药 • germinate 萌发

### Objective

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Sheet 16.3 had two questions on this unit; the syllabus has twelve statements. This sheet is the rest of it: every part of a flower **with its function**, how a **wind-pollinated** 风媒 flower differs from an **insect-pollinated** 虫媒 one, the difference between **self-pollination** 自花传粉 and **cross-pollination** 异花传粉 and what each does to a population, the growth of the **pollen tube** 花粉管 to fertilisation, and the conditions a seed needs to **germinate** 萌发. This sheet covers syllabus 16.3.

**You must be able to:**

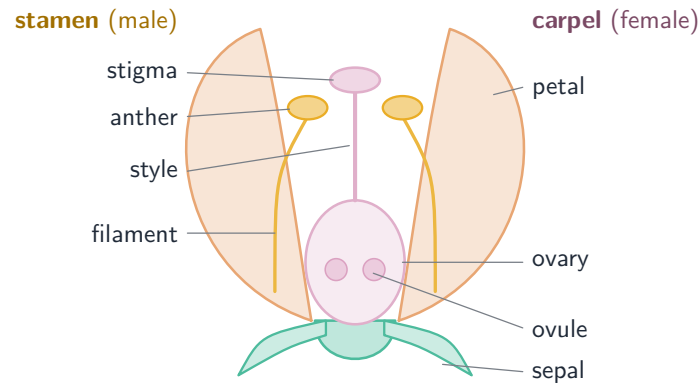
- identify and draw the **sepals** 萼片, **petals** 花瓣, **stamens** 雄蕊, **filaments** 花丝, **anthers** 花药, **carpels** 心皮, **style** 花柱, **stigma** 柱头, **ovary** 子房 and **ovules** 胚珠 of an insect-pollinated flower, and state the function of each
- identify and describe the anthers and stigmas of a wind-pollinated flower, and distinguish the **pollen grains** 花粉粒 of the two kinds
- describe the structural adaptations of insect-pollinated and wind-pollinated flowers
- describe **pollination** 传粉 as the transfer of pollen grains from an anther to a stigma, and distinguish self-pollination from cross-pollination
- discuss the effects of self- and cross-pollination on a population, in terms of **variation** 变异, the capacity to respond to a changing environment, and reliance on **pollinators** 传粉者
- state that fertilisation occurs when a pollen nucleus fuses with a nucleus in an ovule, and describe the growth of the pollen tube
- investigate and describe the conditions needed for germination: water, oxygen and a suitable temperature

### 1 Worked examples

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Study these first. Each one shows a **method** that a question later on this sheet needs.

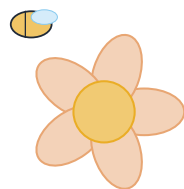
■ Every part, with its one function



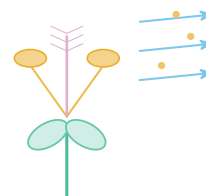
| part                            | function                                                                                  |
|---------------------------------|-------------------------------------------------------------------------------------------|
| sepal                           | protects the flower while it is still a bud                                               |
| petal                           | large and brightly coloured, to <b>attract insects</b>                                    |
| stamen = filament + anther      | the male part; the <b>anther makes pollen grains</b> , and the filament holds it in place |
| carpel = stigma + style + ovary | the female part                                                                           |
| stigma                          | the surface that <b>receives pollen grains</b> ; sticky in an insect-pollinated flower    |
| style                           | the stalk the pollen tube grows down                                                      |
| ovary                           | contains the <b>ovules</b>                                                                |
| ovule                           | contains the female nucleus; becomes the <b>seed</b> 种子 after fertilisation               |

- Every one of the **structures** listed in the table has exactly **one** function to state, and the exam asks for the structures listed there by name.
- Marks come from the **pairing**, not the name. “Anther – makes pollen” is the answer; “anther” alone is not.

■ Insect-pollinated or wind-pollinated?



**insect-pollinated**  
bright petals, scent + nectar;  
sticky, spiky pollen



**wind-pollinated**  
small dull petals; anthers &  
stigma hang out; light pollen

|                  | <b>insect-pollinated</b>                                                  | <b>wind-pollinated</b>                                                               |
|------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| petals           | large, brightly coloured, scented                                         | small, green, or absent                                                              |
| <b>nectar</b> 花蜜 | present, to attract insects                                               | absent                                                                               |
| anthers          | <b>inside</b> the flower, so an insect brushes them                       | <b>hanging outside</b> , so the wind shakes the pollen out                           |
| stigma           | <b>inside</b> , small and <b>sticky</b>                                   | <b>outside</b> , large and <b>feathery</b> , to catch pollen from the air            |
| pollen grains    | <b>larger</b> , <b>fewer</b> , sticky or spiky so they cling to an insect | <b>smaller</b> , <b>very many</b> , smooth and light so they are carried by the wind |

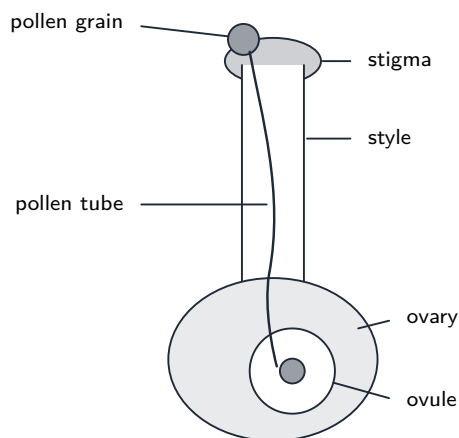
- Every row is an **adaptation to how the pollen travels**. Say what the feature does, not just what it looks like.

#### ■ Self-pollination and cross-pollination

- **Self-pollination:** pollen goes from an anther to the stigma **of the same flower**, or of a different flower **on the same plant**.
- **Cross-pollination:** pollen goes from an anther to the stigma of a flower **on a different plant of the same species**.

|                                           | <b>cross-pollination</b>                                                                                       | <b>self-pollination</b>                                                 |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| variation in the offspring                | <b>more</b> – the two parents have different alleles                                                           | <b>less</b>                                                             |
| responding to a change in the environment | <b>better:</b> a varied population is more likely to contain individuals that survive a new disease or climate | <b>worse</b>                                                            |
| reliance on a pollinator                  | <b>depends</b> on an insect or on the wind                                                                     | <b>does not need</b> one, so it still works when pollinators are scarce |

#### ■ From pollination to fertilisation



**Pollination** is the transfer of a pollen grain from an *anther* to a *stigma*. It happens before anything grows.

**Fertilisation** is the fusion of a *pollen nucleus* with a *nucleus in the ovule*, at the bottom of the tube. The two words are not interchangeable.

1. A pollen grain lands on the **stigma** – that is **pollination**, and nothing has grown yet.
  2. The grain grows a **pollen tube** down through the **style**.
  3. The tube reaches the **ovary** and enters an **ovule**.
  4. The **pollen nucleus fuses with a nucleus in the ovule** – that is **fertilisation**.
  5. The fertilised ovule becomes a **seed**, and the ovary becomes the fruit.
- Pollination and fertilisation are two different events, separated by the growth of the tube. Using one word for the other is the most common lost mark on this unit.

#### ■ What a seed needs to germinate



**A** damp cotton wool, air, warm room

**germinates**



**B** dry cotton wool, air, warm room

**does not germinate**



**C** boiled water under a layer of oil, so *no oxygen*; warm room

**does not germinate**



**D** damp cotton wool, air, *in a fridge*

**does not germinate**

**A** is the control: it has all three conditions. Each of the others is missing exactly **one**, so when it fails to germinate you know which condition mattered.

A seed needs exactly three things: **water**, **oxygen** and a **suitable temperature**.

- **Water** softens the seed coat and lets **enzymes** work, so the stored food can be digested and used.
- **Oxygen** is needed for **aerobic respiration**, which releases the energy for growth.

- A **suitable temperature** is needed because the enzymes work best at their optimum; too cold and they work too slowly, too hot and they are **denatured**.
- The experiment removes **one** condition per tube, and the tube with all three is the **control**. That is what makes each result mean something.  $\triangle$  It says nothing about **light** – every tube had the same light, so the investigation cannot test it.

## 2 Practice

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Now use the methods above.

**2.1** Name the part of a flower that makes pollen grains, and the part that receives them. [2]

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**2.2** State the function of the sepals and the function of the petals of an insect-pollinated flower. [2]

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**2.3** Describe **two** ways in which a wind-pollinated flower differs from an insect-pollinated flower, and explain each difference. [4]

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**2.4** State the difference between pollination and fertilisation. [2]

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**2.5** Describe what is meant by self-pollination. [2]

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**2.6** State the **three** conditions a seed needs in order to germinate. [3]

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### 3 Exam-style questions

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**3.1** Which feature is typical of a wind-pollinated flower? [1]

|   |   |
|---|---|
| A | B |
| C | D |

- A** large, brightly coloured petals
- B** nectar at the base of the flower
- C** anthers hanging outside the flower
- D** a small, sticky stigma inside the flower

**3.2** An orchard contains many apple trees of the same variety. Bees carry pollen between them.

(a) Describe what is meant by cross-pollination. [2]

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(b) Explain one advantage of cross-pollination to a population of apple trees. [2]

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(c) Explain one disadvantage of cross-pollination compared with self-pollination. [2]

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**3.3** A student investigated germination. She put ten cress seeds into each of four test tubes and left them for a week.

| tube | conditions                               | number of seeds that germinated |
|------|------------------------------------------|---------------------------------|
| A    | damp cotton wool, air, 20 °C             | 9                               |
| B    | dry cotton wool, air, 20 °C              | 0                               |
| C    | boiled water under a layer of oil, 20 °C | 1                               |
| D    | damp cotton wool, air, 4 °C              | 0                               |

(a) State which tube is the control, and explain why it is needed. [2]

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(b) Explain what tubes **A** and **B** together show. [2]

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(c) Explain why the water in tube **C** was boiled and then covered with a layer of oil. [2]

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(d) One seed germinated in tube **C**. Suggest why. [2]

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(e) Explain why no seeds germinated in tube **D**. [2]

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(f) The student concluded that seeds need light in order to germinate. Explain why her results do not support this conclusion. [2]

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