

16.3.1 Flower structure, pollination, fertilisation and germination

Name: _____ Class: _____ Date: _____ Total: 34 marks

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

Objective

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.

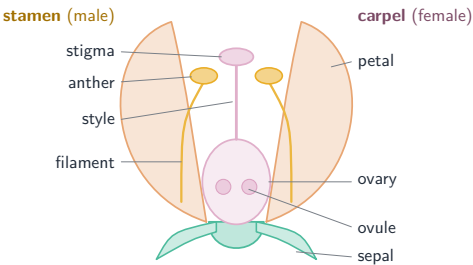
You must be able to:

- 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

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

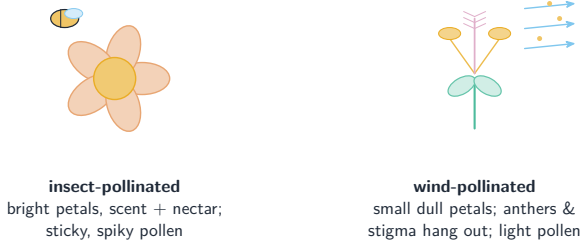
■ Every part, with its one function



part	function
sepal	protects the flower while it is still a bud
petal	large and brightly coloured, to attract insects
stamen = filament + anther	the male part; the anther makes pollen grains , and the filament holds it in place
carpel = stigma + style + ovary	the female part
stigma	the surface that receives pollen grains ; sticky in an insect-pollinated flower
style	the stalk the pollen tube grows down
ovary	contains the ovules
ovule	contains the female nucleus; becomes the seed 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	wind-pollinated
petals	large, brightly coloured, scented	small, green, or absent
nectar 花蜜	present, to attract insects	absent
anthers	inside the flower, so an insect brushes them	hanging outside , so the wind shakes the pollen out
stigma	inside , small and sticky	outside , large and feathery , to catch pollen from the air
pollen grains	larger , fewer , sticky or spiky so they cling to an insect	smaller , very many , smooth and light so they are carried by the wind

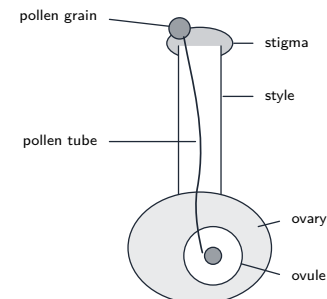
- Every row is an **adaptation to how the pollen travels**. Say what the feature does, not just what it looks like.

■ 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**.

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

■ From pollination to fertilisation

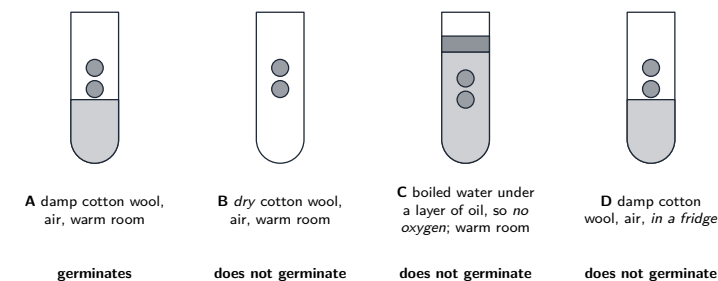


Pollination is the transfer of a pollen grain from an *anther* to a *stigma*. It happens before anything grows.

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 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. △ It says nothing about **light** – every tube had the same light, so the investigation cannot test it.

2 Practice

Now use the methods above.

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

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

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

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

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

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

3 Exam-style questions

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]

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

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

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]

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

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

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

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

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