Reproduction

IGCSE Biology ▪ Topic 16

IGCSE Biology

What we will cover

1. Asexual vs sexual
2. Flowers & pollination
3. Fertilisation in plants
4. Human reproduction
5. Pregnancy & hormones
6. STIs

1 Two kinds

Asexual vs sexual reproduction

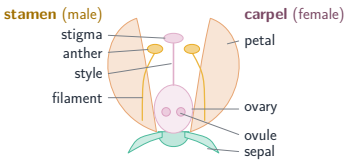
asexual 无性生殖
one parent; identical **clones** 克隆; fast but no variation

sexual 有性生殖
two parents; **gametes** 配子 fuse at **fertilisation** 受精; gives **variation** 变异

Flowers are reproductive structures

2 Plants

Parts of a flower



- **insect-pollinated** flowers have bright petals, scent and nectar, and sticky or spiky pollen, to attract insects and stick to them.
- **wind-pollinated** flowers have small dull petals, anthers and stigmas that hang outside, and light, smooth pollen that blows in the wind.

The parts, and which sex they belong to

Stamens — The male parts. Each of the **stamens** 雄蕊 is a **filament** 花丝 holding up an **anther** 花药, where pollen is made.

Carpel — The female part: **stigma** 柱头, **style** 花柱 and **ovary** 子房 holding the ovules.

Petals and sepals — Petals attract **pollinators** 传粉者; sepals protected the bud before it opened.

Wind or insect — An insect-pollinated flower has large bright petals, nectar and sticky stigmas; a wind-pollinated one has small dull parts, anthers hanging outside and feathery stigmas.

> Every difference between the two kinds of flower follows from one question: what is carrying the pollen?

The parts of a flower, and what each does

Part	What it does
sepals 萼片	protect the flower bud before it opens
petals	attract insects (bright) or are small and dull (wind)
anther 花药	makes and releases the pollen
stigma 柱头	catches the pollen
ovary 子房	holds the **ovules** 胚珠, which become the seeds

> Anther and stigma are the pair to keep straight: pollen leaves the anther and lands on the stigma. Everything else is packaging or protection.

The male reproductive system, part by part

Part	What it does
testes 睾丸	make the sperm, and testosterone
scrotum 阴囊	holds the testes outside the body, kept slightly cool
sperm ducts	carry sperm away from the testes
prostate gland 前列腺	adds fluid to the sperm to make semen
urethra 尿道	carries semen – and, at other times, urine – out through the penis

> The scrotum's job is temperature: sperm production needs a few degrees below body heat, which is why the testes hang outside.

The female reproductive system, part by part

Part	What it does
ovaries 卵巢	make the egg cells, and oestrogen
oviducts 输卵管	carry the egg towards the uterus – fertilisation happens here
uterus 子宫	where the baby develops
cervix	the neck of the uterus
vagina 阴道	receives the penis; also the birth canal

> Fertilisation in the oviduct, development in the uterus – a very common one-mark question, and easy to swap by accident.

Pollination

Pollination 传粉: pollen moves from anther to stigma.

- insect – bright petals, scent, sticky pollen
- wind – small dull flowers, light pollen

(Supplement) Self-pollination 自花传粉 is pollen reaching a stigma on the *same* plant; **cross-pollination** 异花传粉 is pollen reaching a *different* plant – more variation, and the reason most flowers work to avoid selfing.

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

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

Fertilisation in plants

fertilisation
a **pollen tube** 花粉管 grows down the style; nuclei fuse in the **ovule** 胚珠

germination 萌发
a seed needs water, oxygen & a suitable temperature

3 Humans

Human reproductive systems

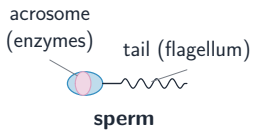
male
testes 睾丸 make **sperm** 精子; sperm ducts → **urethra** 尿道 → penis

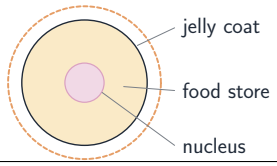
female
ovaries 卵巢 make **eggs** 卵细胞; **oviduct** 输卵管 → **uterus** 子宫

Gametes: sperm and egg

- **sperm** 精子 – small, many, swims (**flagellum** 鞭毛)
- **egg cell** 卵细胞 – large, few (about one a month), stores food

Fertilisation = the two nuclei fusing. Sperm are made in millions and eggs in ones, which is the difference every comparison question turns on.





Two cells built for opposite jobs

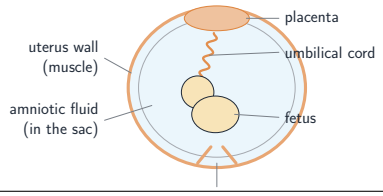
The sperm	Small and mobile: a tail, many **mitochondria** 线粒体 for energy, and **enzymes** 酶 in the **acrosome** 顶体 to break into the egg.
The egg	Large and still: a store of food, and a **jelly coat** 胶质层 that changes after fertilisation to keep other sperm out.
Haploid and diploid	Gamete nuclei are **haploid** 单倍体 – one set of **chromosomes** 染色体; the zygote's nucleus is **diploid** 二倍体, with two.
After fertilisation	The zygote divides into an **embryo** 胚胎, a ball of cells that **implants** 着床 into the lining of the uterus.

Each adaptation answers a job: the sperm must travel and enter, the egg must feed the embryo and admit only one sperm.

Pregnancy and the fetus

The **fetus** 胎儿 grows in the uterus:

- **placenta** 胎盘 – exchanges food, gases & waste
- **umbilical cord** 脐带 – joins fetus to placenta
- **amniotic sac** 羊膜囊 – fluid cushions it

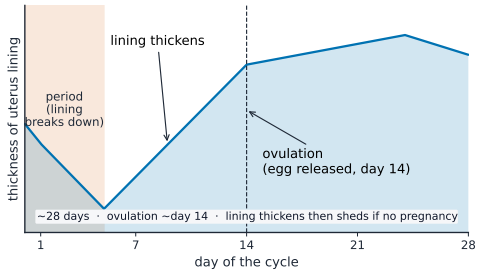


Puberty and the menstrual cycle

At **puberty** 青春期, sex hormones bring **secondary sexual characteristics** 第二性征.

The ∼28-day cycle: lining thickens → **ovulation** 排卵 (day 14) → a period if no pregnancy.

Puberty and the menstrual cycle, in detail



The lining thickens, an egg is released at day 14, and a period follows if there is no pregnancy

Sexually transmitted infections

HIV / AIDS

a **virus** 病毒 spread in body fluids; can lead to AIDS

control

condoms, fewer partners, testing & treatment, no shared needles

Asexual reproduction

advantage: fast, needs only one parent **disadvantage**: no variation

identical clones - an even, reliable crop when conditions are good

a new **disease** can kill them all - one weakness is shared by every one

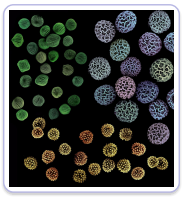
Asexual reproduction is fast but gives no variation, so one disease can kill every identical offspring

Clones, and what a seed still needs

Genetically identical	The **offspring** 后代 have exactly the same **genes** 基因 as the parent – they are clones, so no variation arises.
Why that is useful	One parent, no pollinator, and a fast spread when conditions suit. It is the strategy of a plant that is already succeeding where it stands.
Why it is risky	No variation means one disease, or one change in conditions, can take the whole population.
Germination	A **seed** 种子 will only **germinate** 萌发 when it has water, **oxygen** 氧气 and a suitable **temperature** 温度 – light is not on that list.

Cross-pollination buys **variation** 变异, and pays for it by depending on **pollinators** 传粉者 or wind.

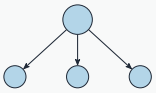
Pollination, continued



Pollen grains seen under an electron microscope (colour added); each plant has its own pattern

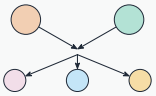
Two kinds of reproduction

asexual - one parent



offspring are **identical** clones

sexual - two parents



gametes join → **varied** offspring

Asexual reproduction needs one parent and gives identical clones; sexual reproduction needs two and gives varied offspring

Sexual reproduction, and what crosses the placenta

the advantage	variation means some offspring may survive if the environment changes
the cost	it needs two parents, and it is slower than asexual reproduction
the placenta 胎盘	where dissolved nutrients, gases and wastes are exchanged between the mother's blood and the fetus's
the blood does not mix	the two circulations stay separate; only dissolved substances cross
amniotic fluid 羊水	surrounds the fetus, protecting it from shock and keeping the temperature steady
(Supplement)	some **pathogens** 病原体 and **toxins** 毒素 – alcohol, nicotine, rubella, HIV – can cross the placenta and harm the fetus

> The placenta is a selective exchange surface, not a filter. Naming what it lets through *and* what harms the fetus is the marked pair.

Exam tips

- Asexual: one parent, identical offspring (no variation). Sexual: two parents, gametes fuse, offspring show variation.
- Fertilisation = fusion of two gamete nuclei → zygote. (Supplement: gametes haploid, zygote diploid.)
- Learn the flower parts and which are male (stamen) and female (carpel). Compare insect- and wind-pollinated flowers.

Exam tips (continued)

- Sperm: small, many, moving (flagellum). Egg: large, few, with a food store.
- Menstrual cycle: lining thickens → ovulation (day 14) → period if no fertilisation. (Supplement: FSH, LH, oestrogen, progesterone.)
- HIV is a virus that causes an STI and can lead to AIDS; it spreads through body fluids.

4 Recap

Worked example – wind or insect pollinated?

A flower has small dull green petals, no scent, and feathery stigmas hanging outside. How is it pollinated?

- No bright petals and no scent ⇒ nothing is attracting an insect.
- Feathery stigmas hanging outside are built to catch pollen from the air.
- Anthers will also hang out, releasing large amounts of light, smooth pollen.
- So: wind pollinated.

> Insect-pollinated: big bright scented petals, nectar, sticky pollen, enclosed anthers/stigmas. Wind: small, dull, exposed, huge amounts of light pollen.

Topic 16 – key takeaways

1. **Two kinds** — asexual: clones; sexual: variation
2. **Flowers** — stamen male, carpel female; insect/wind
3. **Gametes** — sperm small & many; egg large & few
4. **Cycle** — lining thickens, ovulation day 14, period

Check yourself

1. Which reproduction gives variation?
2. Which flower part makes pollen?
3. How is a sperm cell adapted to move?
4. On about which day is an egg released?

Answers **1.** sexual reproduction **2.** the anther **3.** it has a tail (flagellum) **4.** about day 14