

CLASS 9 SCIENCE

Chapter 11 Notes

Reproduction: How Life Continues

Chapter focus

Reproduction ensures continuity of life. This chapter covers asexual and sexual reproduction, vegetative propagation, budding and spore formation, mitosis and meiosis, reproduction in flowering plants and animals, human reproduction, menstruation, pregnancy, sexual maturity, contraception and prevention of sexually transmitted infections.

1. Reproduction and Continuity of Life

- Every organism has a life span: it is born, grows, matures, reproduces and eventually dies.

Reproduction

Reproduction is the biological process by which living beings produce new individuals of their own kind. It ensures continuity of life and transfer of genetic information.

- Living beings reproduce mainly in two ways: asexual reproduction and sexual reproduction.
- Asexual reproduction involves one parent and generally produces genetically identical offspring.
- Sexual reproduction involves genetic contribution from two individuals and creates variations among offspring.
- Variations can help organisms adapt to changing environments and contribute to evolution over generations.

2. Asexual Reproduction

- Asexual reproduction occurs in unicellular organisms such as bacteria, amoeba and yeast, simple multicellular organisms such as hydra and sponge and many plants.
- The central cell-division process behind the asexual methods is mitosis.

Mitosis and clones

Mitosis produces daughter cells with the same chromosome number as the parent cell. Therefore, asexually produced offspring are genetically identical to the parent and are called clones.

3. Vegetative Propagation in Plants

Vegetative propagation

Formation of new plants from vegetative or growing parts of an existing plant, without seed formation, is called vegetative propagation.

Plant / part	Example
Underground stem	Potato, ginger
Stem cutting	Money plant, sugarcane
Leaf	Bryophyllum

- Vegetative propagation allows rapid multiplication of plants with desirable characteristics.
- Scientists and horticulturists use cutting, grafting, layering and tissue culture for large-scale propagation.

Cutting

- A suitable shoot cutting is prepared from the parent plant.
- Leaves from the lower part are removed.
- The cutting is inserted partly into soil mixed with compost and watered regularly.
- The cutting develops roots and grows into a new plant.

Grafting

- A healthy rooted plant provides the stock.
- A healthy stem piece from another desired variety is inserted into a slit made in the stock.
- The joint is wrapped and protected until it heals.
- Grafting allows desirable varieties to be propagated together on a rooted plant.

Layering

- A flexible twig is bent and its middle part is buried under the soil while still attached to the parent.
- Roots develop from the buried part.
- After roots form, the twig is cut from the parent and grows independently.

Tissue Culture

- Tissue culture can mass-produce healthy plantlets from small pieces of plant tissue such as shoot tips.
- The banana farming as an example where healthy plantlets can help eliminate virus-infected plants and improve yields.

4. Budding

Budding

In budding, repeated cell division at a particular site forms a small outgrowth called a bud. The bud enlarges and may separate from the parent to live independently.

- Yeast shows small round buds emerging from parent cells.
- Hydra may have several buds growing on its body at the same time.

5. Spore Formation in Fungi

- Bread mould develops from fungal spores already present in the air.
- Spores may be formed inside sac-like structures or on swollen structures associated with fungal hyphae.
- They are produced in huge numbers, are lightweight and can be carried by air currents.
- With moisture, nutrients and suitable warmth, spores germinate rapidly into new individuals.
- Lower temperatures slow or stop mould reproduction; this is one reason refrigeration helps preserve food.

6. Sexual Reproduction and Meiosis

- Sexual reproduction involves two parents contributing genetic material to the offspring.

Meiosis

Meiosis is a special type of cell division that forms gametes and reduces the chromosome number from diploid to haploid.

- Humans have 46 chromosomes or 23 pairs in ordinary body cells.
- Human gametes have 23 chromosomes.
- In animals, male gametes are sperm and female gametes are eggs.
- In flowering plants, pollen grains carry male gametes to ovules containing female gametes.
- During meiosis, chromosomes separate into gametes in different combinations, creating genetic variation.
- Variation is important for survival, adaptation and evolution.

7. Sexual Reproduction in Flowering Plants

- Flowering plants are called angiosperms and flowers are their reproductive organs.

Complete flower

A complete flower has four main parts: sepals, petals, stamens and pistil.

Flower part	Main role / structure
Sepal	Outermost whorl; protects the flower in the bud stage.
Petal	Often coloured; helps in attraction of pollinators.
Stamen	Male reproductive part; consists of filament and anther.
Anther	Produces pollen grains containing male gametes.
Pistil	Female reproductive part; consists of stigma, style and ovary.
Stigma	Tip of pistil; may be flat and/or sticky and receives pollen.
Style	Thin tube connecting stigma to ovary.
Ovary	Contains ovules.
Ovule	Contains the egg cell or female gamete.

8. Pollination

Pollination

Transfer of pollen grains from the anther to the stigma of a flower is called pollination.

Type	Meaning
Self-pollination	Pollen reaches the stigma of the same flower or another flower on the same plant.
Cross-pollination	Pollen moves from a flower of one plant to a flower of another plant of the same type.

- Pollination is necessary for fruit and seed formation.

9. Pollination Strategies

Agent	Adaptations / examples
Wind	Wheat, maize and rice: light, small pollen in large numbers; long feathery stigma.
Water	Vallisneria and Hydrilla: water currents carry pollen.
Insects	Sunflower, hibiscus and marigold: bright colours, nectar and fragrance; sticky/spiny pollen.
Birds	Examples include coral tree and hibiscus; birds such as sunbirds can act as pollinators.

- The wind-pollinated grasses may release about 5,00,000-10,00,000 pollen grains per flower for about 50-200 seeds.
- Insect-pollinated plants such as sunflower may release about 20,000-40,000 pollen grains for about 800-1,000 seeds.
- This illustrates differences in the efficiency and strategy of pollen transfer.

10. Fertilisation and Seed Formation

- After compatible pollen reaches the stigma, it germinates and produces a pollen tube.
- The pollen tube grows through the style into the ovary.
- The male gamete travels through the pollen tube and reaches an ovule.

Fertilisation

Fusion of the male and female gametes is called fertilisation. The fertilised egg is called a zygote.

- The zygote develops into an embryo.
- The ovary enlarges and develops into a fruit.
- The ovules develop into seeds.
- Seeds may be dispersed by wind, water or animals.
- Under favourable conditions of water, air and temperature, a seed germinates and grows into a new plant.

11. Sexual Reproduction in Animals

Type of fertilisation	Description	Examples
External fertilisation	Fusion of gametes occurs outside the female body, usually in water.	Frogs and most fish
Internal fertilisation	Fertilisation occurs inside the female body.	Reptiles, birds and mammals

- Animals with external fertilisation generally produce many eggs because many may be destroyed by currents or eaten.
- Internal fertilisation generally gives greater protection to the fertilised egg or embryo.

Animal	Habitat	Fertilisation	Eggs produced	Estimated survival
Fish	Water	External	100s-1000s	Low
Frog	Water/land	External	5,000-50,000	Low
Lizard	Land	Internal	2-20	Moderate
Bird	Water/land	Internal	1-15	Moderate to High

- Fish, amphibians and insects often have a larval feeding stage before transformation into the adult form.
- The butterfly life cycle includes egg, larva, pupa and adult.
- Reptile and bird eggs contain enough yolk to nourish the embryo until hatching.
- In mammals, the zygote grows and develops inside the female body.

12. Reproduction in Human Beings

- Reproductive maturity develops as a child grows into an adult and the reproductive organs begin producing gametes.
- A sperm and an egg can fuse inside the female body to form a zygote, which develops into an embryo and later a foetus.

Male Reproductive System

Part	Function
Testes	Produce sperm and hormones associated with male puberty.
Scrotum	Skin pouch holding testes slightly below normal body temperature, suitable for sperm formation.
Vas deferens	Carries sperm from the testes.
Seminal vesicles and prostate	Add fluids that nourish sperm and help them remain active and move.
Urethra	Common passage for urine and sperm.
Penis	Organ involved in transfer of sperm to the female reproductive tract.

- Each sperm has a head containing genetic material and a long tail that helps it swim.

Female Reproductive System

Part	Function
Ovaries	Produce eggs and female hormones.
Oviducts / fallopian tubes	Connect each ovary to the uterus; fertilisation may occur here.
Uterus	Bag-like organ where the foetus develops.
Cervix	Narrow passage through which the uterus opens into the vagina.
Vagina	Passage connected to the cervix and involved in reproduction and childbirth.

13. Gametogenesis

Gametogenesis

The process of formation of gametes in the testes and ovaries is called gametogenesis.

- Gametes are formed by meiosis and contain half the chromosome number.

Feature	Sperm	Egg
Size	Very small	Large
Number produced	Millions	Few
Stored nutrients	Absent	Present
Motility	Actively motile	Non-motile

14. Ovulation, Fertilisation and Implantation

- At birth, the ovaries already contain many immature eggs.
- From puberty onward, usually one mature egg is released from an ovary during a cycle. This release is called ovulation.
- Before ovulation, the inner lining of the uterus begins to thicken.
- The released egg travels into the oviduct.
- If a sperm fuses with the egg, a zygote is formed.
- The zygote undergoes mitotic divisions while travelling towards the uterus.

Implantation

The developing zygote attaches to the thick inner lining of the uterus to receive nourishment. This implantation marks the beginning of pregnancy.

IVF

In-vitro fertilisation (IVF) is a medical technique in which an egg and sperm are combined outside the female body and the resulting fertilised egg is then implanted in the uterus.

15. Menstrual Cycle

- If the egg is not fertilised, it remains viable for about a day and then degenerates.
- The thickened uterine lining is no longer needed and is shed with some blood through the vagina. This is called menstruation or a period.
- Menstruation usually lasts about 3-7 days.
- The cycle commonly repeats every 21-35 days, often around 28 days.

Typical 28-day stage	Main event
Day 1-5	Menstruation; uterine lining is shed.
Day 6-14	Uterine lining rebuilds; an egg matures in an ovary.
Around Day 14	Ovulation; a mature egg is released.
Day 15-28	Uterine lining thickens and becomes rich in blood vessels; if fertilisation does not occur, it begins breaking down and the cycle repeats.

- The menstrual cycles generally begin at puberty, around ages 10-14 and continue until menopause, around age 50.

16. Biological Sex Determination

- Females have XX sex chromosomes and males have XY.
- The mother contributes an X chromosome to the baby.
- The father contributes either X or Y.
- An X from the father gives XX, while a Y gives XY. Thus, the sperm contributes the chromosome that determines the baby's biological sex.

17. Pregnancy and Childbirth

- Human pregnancy lasts about nine months and is divided into three trimesters.

Stage	Main development
First trimester	The fertilised egg develops into an embryo; major organs begin forming. From about the ninth week it is called a foetus.
Second trimester	The foetus grows larger and stronger; the mother can usually feel movements.
Third trimester	The baby grows rapidly and prepares for life outside the womb.

- The uterus protects and nourishes the developing baby.
- During childbirth, strong uterine muscle contractions help push the foetus through the birth canal.
- When normal vaginal birth is not possible or safe, medical or surgical procedures may be used for safe delivery.

18. Care of Mother and Baby

- A pregnant woman should have a balanced diet rich in proteins, vitamins and minerals.
- Regular medical check-ups, appropriate rest and medical advice about light exercise are important.
- Harmful substances and medicines without medical advice should be avoided.
- After birth, breastfeeding provides nutrition and helps protect the infant from many diseases.
- Newborns should be kept warm, vaccinated on time and handled gently.
- The mother's physical and emotional well-being also requires care, rest and family support.

19. Sexual Maturity and Responsible Decisions

- Sexual maturation means the body is gradually becoming capable of reproduction.
- Physical sexual maturity does not automatically mean a person is fully ready for adult responsibilities.
- Emotional maturity develops over time and includes managing feelings, communicating clearly and making thoughtful decisions.

20. Sexually Transmitted Infections (STIs)

STIs

Infections that can be transmitted through sexual contact are called sexually transmitted infections.

- Examples include gonorrhoea, herpes, syphilis, genital warts and HIV, which can eventually lead to AIDS.
- Condoms help reduce transmission of STIs and also help prevent pregnancy.

21. Contraceptive Methods

Method	How it works / note
Barrier methods	Condoms or vaginal covers prevent sperm from reaching the egg.
Oral pills	Medicines that alter hormones and change the release of eggs; the side effects may occur.
IUDs	Intra-Uterine Devices such as Copper-T are placed in the uterus to prevent pregnancy.
Surgical methods	Vas deferens in males or fallopian tubes in females may be blocked so sperm and egg cannot meet.

- The prenatal sex determination is prohibited by law in India.
- Responsible choices are important for preventing unplanned pregnancy and sexually transmitted infections.

22. Asexual vs Sexual Reproduction

Feature	Asexual reproduction	Sexual reproduction
Parents involved	One	Two genetic contributors
Gametes	Not involved in the methods discussed	Involved
Main cell division	Mitosis	Meiosis forms gametes; mitosis supports growth after fertilisation
Genetic similarity	Offspring generally genetically identical to parent	Offspring show genetic variation
Speed	Usually rapid	Generally more complex
Examples	Vegetative propagation, budding, spore formation	Flowering plants, most complex animals, humans

23. Key Terms

Term	Meaning
Reproduction	Production of new individuals of the same kind.
Clone	Genetically identical offspring produced asexually.
Vegetative propagation	New plants from vegetative parts.
Budding	New individual develops as a bud on the parent.
Spore	Light reproductive cell/structure capable of germinating under suitable conditions.
Mitosis	Cell division producing daughter cells with the same chromosome number.
Meiosis	Cell division that halves chromosome number to form gametes.
Gamete	Haploid reproductive cell.
Pollination	Transfer of pollen from anther to stigma.
Fertilisation	Fusion of male and female gametes.
Zygote	Fertilised egg.
Embryo	Early developing stage after zygote divisions.
Ovulation	Release of a mature egg from an ovary.
Implantation	Attachment of the developing zygote to the uterine lining.
Menstruation	Shedding of uterine lining when fertilisation does not occur.
Gametogenesis	Formation of gametes.
Contraception	Methods used to prevent pregnancy.
STI	Infection transmitted through sexual contact.

24. Exam-Oriented Self-Check Questions

1. Define reproduction. Why is it necessary for continuity of life?
2. Differentiate between asexual and sexual reproduction.
3. Explain vegetative propagation with suitable examples.
4. Describe cutting, grafting and layering.
5. What is tissue culture and why is it useful in agriculture?
6. Explain budding in yeast and hydra.
7. How do fungi reproduce by spores?
8. Why are offspring produced by asexual reproduction called clones?
9. Define meiosis. How does it help maintain chromosome number across generations?
10. How does meiosis create variation?
11. Name and explain the four main parts of a complete flower.
12. Differentiate between self-pollination and cross-pollination.
13. Describe wind, water, insect and bird pollination.
14. Explain fertilisation and seed formation in a flowering plant.
15. Differentiate between external and internal fertilisation.
16. Why do animals with external fertilisation generally produce more eggs?
17. Describe the male reproductive system in humans.
18. Describe the female reproductive system in humans.
19. What is gametogenesis? Compare sperm and egg.
20. Explain ovulation, fertilisation and implantation.
21. What happens when an egg is not fertilised?
22. Describe the stages of a typical 28-day menstrual cycle.
23. Explain biological sex determination in humans.
24. Describe the three trimesters of pregnancy.
25. Why are proper nutrition, medical check-ups and rest important during pregnancy?
26. What does sexual maturity mean? Why is emotional maturity also important?
27. What are STIs? How can their transmission be reduced?
28. Describe the main contraceptive methods.

One-Minute Chapter Summary

Quick revision

Reproduction produces new individuals and maintains continuity of life. Asexual reproduction involves one parent and includes vegetative propagation, budding and spore formation; mitosis produces genetically identical offspring called clones. Sexual reproduction uses gametes formed by meiosis and produces variation. In flowering plants, pollination transfers pollen to the stigma, fertilisation forms a zygote, the ovule becomes a seed and the ovary becomes a fruit. Animals show external or internal fertilisation. In humans, testes produce sperm and ovaries produce eggs. Fertilisation can form a zygote that implants in the uterus and develops during a roughly nine-month pregnancy. If fertilisation does not occur, menstruation follows. The chapter also explains sexual maturity, reproductive health, contraception and prevention of STIs.