



Chapter 1: Sexual Reproduction in Flowering Plants

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. What is the reproductive part of a flowering plant? **- The flower.**
2. What is the male part of a flower called? **- The Androecium.**
3. The androecium is made of what units? **- Stamens.**
4. A stamen has which two parts? **- The anther and the filament.**
5. What part of the anther makes pollen? **- The microsporangium (or pollen sac).**
6. What is the ploidy of a microspore mother cell? **- Diploid (2n).**
7. How do microspore mother cells form microspores? **- Through meiosis.**
8. What is the ploidy of a pollen grain? **- Haploid (n).**
9. What is the hard outer layer of pollen? **- The exine.**
10. What tough material makes the exine? **- Sporopollenin.**
11. What is the thin inner layer of pollen? **- The intine.**
12. Name the two cells in a mature pollen grain. **- The vegetative cell and generative cell.**
13. Which pollen cell is larger and forms the pollen tube? **- The vegetative cell.**
14. Which pollen cell forms the two male gametes? **- The generative cell.**
15. What is the female part of a flower called? **- The Gynoecium (or pistil).**
16. A pistil has which three parts? **- Stigma, style, and ovary.**
17. Which part of the pistil catches pollen? **- The stigma.**
18. What structure is found inside the ovary? **- The ovule.**
19. After fertilization, what does the ovule become? **- The seed.**
20. What sac inside the ovule holds the egg cell? **- The embryo sac.**
21. What is the ploidy of a megasporangium? **- Diploid (2n).**
22. Meiosis of a megasporangium produces how many megasporangia? **- Four.**
23. How many of the four megasporangia usually survive? **- Only one.**
24. A typical embryo sac has how many cells and nuclei? **- 7 cells, 8 nuclei.**
25. Name the three cells at the micropylar end. **- One egg cell and two synergids.**
26. What do we call the egg cell and its two synergids? **- The egg apparatus.**
27. Name the three cells at the opposite (chalazal) end. **- The antipodal cells.**
28. What is the large cell in the middle of the embryo sac? **- The central cell.**
29. What two nuclei are in the central cell? **- The two polar nuclei.**
30. What is the transfer of pollen to a stigma called? **- Pollination.**
31. Pollination within the same flower is called what? **- Autogamy.**
32. Pollination between flowers on the same plant is called what? **- Geitonogamy.**
33. Pollination between flowers on different plants is called what? **- Xenogamy.**
34. What is pollination by wind called? **- Anemophily.**
35. What is pollination by insects called? **- Entomophily.**
36. What is pollination by water called? **- Hydrophily.**
37. Can the male gametes in flowering plants swim? **- No, they are non-motile.**
38. What tube grows from the pollen grain to the ovule? **- The pollen tube.**
39. How many male gametes does the pollen tube deliver? **- Two.**
40. What is the fusion of a male gamete and the egg cell? **- Syngamy (fertilization).**
41. Syngamy results in what new cell? **- The zygote.**
42. What is a zygote's ploidy? **- Diploid (2n).**
43. What is the second fertilization event in angiosperms? **- Triple fusion.**
44. What three nuclei fuse during triple fusion? **- One male gamete and two polar nuclei.**
45. Triple fusion forms what special nucleus? **- The Primary Endosperm Nucleus (PEN).**
46. What is the endosperm's ploidy? **- Triploid (3n).**
47. What do we call syngamy and triple fusion happening together? **- Double fertilization.**
48. What is the main job of the endosperm? **- To feed the growing embryo.**
49. The zygote grows into what structure? **- The embryo.**
50. What part of the ovule becomes the seed coat? **- The integuments.**
51. After fertilization, what does the ovary become? **- The fruit.**
52. What do we call a fruit that forms without fertilization? **- A parthenocarpic fruit.**
53. The banana is a natural example of what? **- Parthenocarpy.**
54. A fruit that develops only from the ovary is a what? **- A true fruit.**
55. A fruit that develops from more than the ovary is a what? **- A false fruit.**
56. The apple is a common example of what kind of fruit? **- A false fruit.**
57. An embryo developing from an unfertilized egg is called what? **- Parthenogenesis.**
58. What is it called when seeds form without any fertilization? **- Apomixis.**
59. What do we call it when a single seed has multiple embryos? **- Polyembryony.**
60. Polyembryony is common in which type of fruit? **- Citrus fruits.**

IMPORTANT QUESTIONS AND ANSWERS

1. Mention the adaptations of wind-pollinated flowers.

Wind-pollinated (anemophilous) flowers show several adaptations to ensure successful pollination. 1. The flowers are typically small, inconspicuous, and lack bright colors or nectar. 2. They produce huge quantities of pollen grains that are light and non-sticky. 3. The stamens are well-exposed to easily disperse pollen into wind currents, and the stigmas are large and feathery to efficiently trap airborne pollen.

2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone refers to one or more organisms that are morphologically and genetically identical to their single parent, produced through asexual reproduction. An advantage is the preservation of desirable traits, as genetic makeup is unchanged. A disadvantage is the lack of genetic variation, which makes the entire population vulnerable to the same diseases or environmental stresses.

3. What are the names of the component cells of the embryo sac?

A mature angiosperm embryo sac typically contains seven cells. These are: one **egg cell**, two **synergids** (which together form the egg apparatus), three **antipodal cells** at the opposite end, and one large **central cell** which contains two polar nuclei.

4. What do you understand by emasculation? Why is it done?

Emasculation is the surgical removal of anthers from a bisexual flower before they mature and release pollen. This technique is a crucial step in artificial hybridization. It is performed to prevent self-pollination and to ensure that the flower can be cross-pollinated exclusively with pollen from a desired male parent, allowing breeders to create new plant varieties with specific traits.

5. Tell about false fruit with an example.

A false fruit, or pseudocarp, is a fruit that develops from parts of the flower other than the ovary. While a true fruit develops only from the ovary, a false fruit includes tissues like the thalamus or receptacle as a major fleshy part. A well-known example is the apple, where the edible portion is the swollen thalamus, not the ovary.

6. Give the definition of monocarpic fruits with an example.

Monocarpic plants are those that flower, produce fruits, and then die. The term 'monocarpic fruits' refers to the fruits produced by these plants during their single, terminal reproductive event. This strategy allows the plant to invest all its resources into producing offspring once. Examples include the fruits of bamboo and agave.

7. Explain false fruit with an example.

A false fruit is one in which the fleshy, edible part develops from floral tissues other than the ovary. In contrast, a true fruit develops entirely from the ovary. In a false fruit, the thalamus or receptacle often grows to form the main part of the fruit. A good example is the strawberry, where the red fleshy part is the receptacle, and the true fruits are the small achenes on its surface.

8. Write a short note on asexual reproduction in organisms.

Asexual reproduction is a mode of reproduction where offspring arise from a single parent, without the fusion of gametes. The offspring are genetically identical to the parent and are called clones. This method is common in unicellular organisms, simple animals, and many plants. Key methods include binary fission (e.g., Amoeba), budding (e.g., Yeast, Hydra), and vegetative propagation in plants.

9. Explain asexual reproduction in an organism with the help of example.

Asexual reproduction is a process where a single parent gives rise to offspring that are genetically identical to it. For example, the freshwater organism *Hydra* reproduces asexually through budding. A small bud develops as an outgrowth on the parent's body. This bud grows, develops tentacles and a mouth, and eventually detaches to live as an independent individual.

10. Define the following: (i) Protozoan endoparasite (ii) Ovule

(i) **Protozoan endoparasite:** This is a single-celled eukaryotic parasite that lives inside the body of its host, deriving nourishment and causing harm. An example is *Plasmodium*, the protozoan that causes malaria in humans. (ii) **Ovule:** This is the structure within a flowering plant's ovary that contains the female gamete (egg). After fertilization, the ovule matures into a seed.

11. Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenocarpic fruits (iv) Polyembryony

(i) **False Fruit:** A fruit formed from parts other than the ovary. Example: Apple. (ii) **True Fruit:** A fruit formed solely from the ovary. Example: Mango. (iii) **Parthenocarpic Fruit:** A fruit that develops without fertilization, making it seedless. Example: Banana. (iv) **Polyembryony:** The occurrence of more than one embryo in a seed. Example: Citrus fruits.

12. What is the importance of embryosac in angiospermic plants?

The embryo sac is fundamentally important for sexual reproduction in angiosperms. It contains the egg cell, which upon fertilization forms the zygote (the future embryo). It also contains the central cell with polar nuclei, which after fertilization forms the primary endosperm nucleus. This nucleus develops into the endosperm, a nutritive tissue that provides food for the embryo's development and germination.

13. Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.

A diagram would depict an oval structure. At the micropylar end, label the **egg apparatus**, consisting of one central **egg cell** and two **synergids**. At the opposite chalazal end, label the three **antipodal cells**. In the center, label the large **central cell** containing the two **polar nuclei**.

14. Define cross-pollination with the help of suitable example.

Cross-pollination, or xenogamy, is the transfer of pollen from the anther of a flower on one plant to the stigma of a flower on a different plant of the same species. It requires external agents like wind, water, or animals. For example, maize plants rely on wind for cross-pollination, releasing large amounts of pollen to be carried to the tassels of other plants.

15. What do you understand by parthenogenesis ? Explain with example.

Parthenogenesis is a natural form of asexual reproduction where an embryo develops from an unfertilized ovum. This process does not require fertilization by a male gamete. A common example is seen in honey bees, where the queen bee lays unfertilized eggs that develop into haploid male bees, known as drones.

16. Describe the structure of microsporangium.

A young microsporangium (pollen sac) has a circular structure with four distinct wall layers. From outermost to innermost, they are the **epidermis**, the **endothecium**, the **middle layers**, and the **tapetum**. The tapetum is the nutritive layer for developing pollen grains. At the center is the **sporogenous tissue**, composed of microspore mother cells which undergo meiosis to form microspores (pollen grains).

17. Explain double fertilization.

Double fertilization is a characteristic feature of angiosperms. After the pollen tube releases two male gametes into the embryo sac, two fusion events occur: 1. **Syngamy:** One male gamete fuses with the egg cell to form the diploid ($2n$) zygote. 2. **Triple Fusion:** The second male gamete fuses with the two polar nuclei in the central cell, forming the triploid ($3n$) primary endosperm nucleus, which develops into the endosperm.

18. What is double fertilisation? in which plant group does it occur?

Double fertilization is a complex reproductive process unique to **angiosperms** (flowering plants). It involves two key events: the fusion of one male gamete with the egg cell to form the diploid zygote, and the fusion of the second male gamete with the two polar nuclei to form the triploid endosperm.



Chapter 2: Human Reproduction

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. What is the process of forming gametes called? - **Gametogenesis.**
2. What are the primary male reproductive organs? - **The testes.**
3. Where are the testes located outside the abdominal cavity? - **In the scrotum.**
4. Why is the scrotum located outside the body? - **To maintain a lower temperature for sperm production.**
5. What are the functional units of the testes where sperm are produced? - **The seminiferous tubules.**
6. What are the two main types of cells in the seminiferous tubules? - **Male germ cells (spermatogonia) and Sertoli cells.**
7. What is the function of Sertoli cells? - **To provide nutrition to the developing sperm.**
8. What cells outside the tubules secrete androgens like testosterone? - **Interstitial cells (or Leydig cells).**
9. What hormone directly controls spermatogenesis? - **Androgens (like testosterone).**
10. What is the correct sequence of cells during spermatogenesis? - **Spermatogonia → primary spermatocytes → secondary spermatocytes → spermatids → spermatozoa.**
11. What is the process of sperm formation called? - **Spermatogenesis.**
12. What is the ploidy of spermatogonia and primary spermatocytes? - **Diploid (2n).**
13. What is the ploidy of secondary spermatocytes and spermatids? - **Haploid (n).**
14. What are the three distinct regions of a mature sperm? - **Head, middle piece, and tail.**
15. What cap-like structure covers the anterior part of the sperm head? - **The acrosome.**
16. What is the function of the acrosome? - **It contains enzymes to help fertilize the ovum.**
17. What provides energy for sperm movement and is found in the middle piece? - **Mitochondria.**
18. What are the primary female reproductive organs? - **The ovaries.**
19. What are the two main functions of the ovaries? - **Producing the female gamete (ovum) and secreting female hormones.**
20. What is the process of ovum formation called? - **Oogenesis.**
21. Which female reproductive cell is haploid? - **The secondary oocyte.**
22. What is the ploidy of a human gamete (sperm or ovum)? - **Haploid, containing 23 chromosomes.**
23. What is the ploidy of a human zygote? - **Diploid, containing 46 chromosomes.**
24. Which organelle, essential for cell division, is absent from the ovum's cytoplasm? - **The centrosome.**
25. The female reproductive cycle in primates (humans, monkeys) is called what? - **The menstrual cycle.**
26. What is the term for the first occurrence of menstruation? - **Menarche.**
27. In which uterine layer do the major cyclic changes occur? - **The endometrium.**
28. Which three hormones are the primary regulators of the menstrual cycle? - **LH, FSH, and Estrogen.**
29. What is the release of an ovum from the ovary called? - **Ovulation.**
30. Which hormone surge is the main trigger for ovulation? - **Luteinizing Hormone (LH).**
31. On approximately which day of the menstrual cycle does ovulation occur? - **The 14th day.**
32. After ovulation, the ovum is surrounded by a layer of cells called what? - **The corona radiata.**
33. After ovulation, what does the ruptured Graafian follicle develop into? - **The corpus luteum.**
34. What is the primary hormone secreted by the corpus luteum? - **Progesterone.**
35. What is the main function of progesterone? - **To maintain the endometrium for pregnancy.**
36. What hormone is secreted by the corpus luteum and placenta to relax pelvic ligaments? - **Relaxin.**
37. In which part of the fallopian tube does fertilization typically occur? - **The ampillary region.**
38. What do we call fertilization that occurs inside the female's body? - **Internal fertilization.**
39. What is fertilization that occurs outside the body, as in jellyfish? - **External fertilization.**
40. The attachment of the blastocyst to the uterine wall is called what? - **Implantation.**
41. What organ connects the developing fetus to the uterine wall? - **The placenta.**
42. What structure forms a pore known as the blastopore during embryonic development? - **The gastrula.**
43. From which primary germ layer does the human heart develop? - **The mesoderm.**
44. After how long is the embryo's heart formed? - **After one month of pregnancy.**
45. When do the limbs and digits of the embryo develop? - **By the end of the second month.**
46. Approximately how many eggs does a healthy human female ovulate in her lifetime? - **About 400.**
47. Which animal is a hermaphrodite (has both male and female organs)? - **The earthworm.**
48. Which common insect is not a hermaphrodite? - **The housefly.**
49. What term describes animals that lay eggs, like hens and crocodiles? - **Oviparous.**

IMPORTANT QUESTIONS AND ANSWERS

1. Mention the adaptations of wind-pollinated flowers.

Wind-pollinated (anemophilous) flowers have several key adaptations:

1. They are typically small, inconspicuous, and lack bright colors, nectar, and fragrance as they do not need to attract pollinators.
2. The pollen grains are lightweight, non-sticky, and produced in very large quantities to increase the chances of reaching a stigma.
3. The stigma is often large and feathery to effectively trap airborne pollen grains.

2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone is a group of organisms that are genetically identical to each other and to their single parent, produced through asexual reproduction.

Advantage: It is a rapid method of multiplication and preserves the desirable qualities of the parent plant, such as high yield or disease resistance, without any variation.

Disadvantage: A major disadvantage is the complete lack of genetic variation. If the parent is susceptible to a particular disease or environmental change, all its clones will also be equally vulnerable, potentially leading to the destruction of the entire population.

3. What are the names of the component cells of the embryo sac?

A mature angiosperm embryo sac is a 7-celled, 8-nucleate structure. The component cells are:

1. **Egg Apparatus:** Located at the micropylar end, it consists of one large **egg cell** and two flanking **synergids**.
2. **Antipodal Cells:** Three cells located at the chalazal end.
3. **Central Cell:** One large cell in the center that contains two **polar nuclei**.

4. What do you understand by emasculation? Why is it done?

Emasculation is the process of removing the anthers from a bisexual flower before they mature, without affecting the female reproductive part (pistil). It is a crucial step in artificial hybridization programs. The primary reason for performing emasculation is to prevent self-pollination and ensure that the stigma is pollinated only by the desired pollen grains from a different plant, thus facilitating cross-pollination for creating improved plant varieties.

5. Tell about false fruit with an example.

A false fruit (or pseudocarp) is a fruit that develops from floral parts other than the ovary. While a true fruit develops solely from the ripened ovary, a false fruit incorporates other parts like the thalamus, receptacle, or calyx, which grow and become the fleshy, edible part of the fruit. A classic example is the apple, where the main edible portion is the fleshy thalamus, not the ovary.

6. Give the definition of monocarpic fruits with an example.

The term 'monocarpic' refers to plants that flower, set seeds, and then die. Therefore, 'monocarpic fruits' are the fruits produced by such plants during their single reproductive cycle. These plants invest all their energy into this one reproductive event. Common examples of monocarpic plants include bamboo species and agave, which flower and fruit only once in their lifetime before dying.

7. Explain false fruit with an example.

A false fruit, also known as a pseudocarp, is a fruit in which some of the fleshy part is derived not from the ovary but from some adjacent tissue exterior to the carpel. In a true fruit, the entire fruit develops from the ovary. In a false fruit, parts like the thalamus or floral tube become the major fleshy part. A common example is a strawberry, where the fleshy part is the receptacle, and the actual fruits are the tiny achenes on its surface.

8. Write a short note on asexual reproduction in organisms.

Asexual reproduction is a mode of reproduction where offspring arise from a single parent, without the fusion of gametes. The offspring produced are genetically identical to the parent and are referred to as clones. This process is common in simpler organisms like bacteria, amoeba, and yeast, as well as in many plants. Common methods of asexual reproduction include binary fission (in Amoeba), budding (in Yeast and Hydra), and vegetative propagation in plants (e.g., through runners or tubers).

Explain asexual reproduction in an organism with the help of example.

Asexual reproduction is a biological process where a single parent produces offspring that are genetically identical to itself. This mode of reproduction does not involve the fusion of gametes. For example, in yeast, a form of asexual reproduction called budding occurs. A small bud or outgrowth forms on the parent yeast cell. The nucleus of the parent cell divides, and one daughter nucleus migrates into the bud. The bud grows and eventually detaches to become a new, independent yeast cell.

10. Define the following: (i) Protozoan endoparasite (ii) Ovule

(i) **Protozoan endoparasite:** A single-celled eukaryotic organism (protozoan) that lives inside the body of another organism (the host) and derives nourishment from it, often causing disease. An example is *Plasmodium*, which lives inside human red blood cells and causes malaria.

(ii) **Ovule:** The ovule is the structure within the ovary of a flowering plant that contains the female gamete (egg cell). After fertilization, the ovule develops into a seed.

11. Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenocarpic fruits (iv) Polyembryony

(i) **False Fruit:** A fruit that develops from floral parts other than the ovary, such as the thalamus. **Example:** Apple.

(ii) **True Fruit:** A fruit that develops solely from the ripened ovary of a flower. **Example:** Mango.

(iii) **Parthenocarpic Fruits:** Fruits that develop without the process of fertilization. These fruits are typically seedless. **Example:** Banana.

(iv) **Polyembryony:** The phenomenon of having more than one embryo developing within a single seed. **Example:** Citrus fruits like orange and lemon.

12. What is the importance of embryosac in angiospermic plants?

The embryo sac (female gametophyte) is of critical importance as it contains all the necessary cells for sexual reproduction in angiosperms. Its primary role is to house the female gamete (the egg cell) for fertilization. Furthermore, it contains the central cell with two polar nuclei, which, after fusion with a male gamete, develops into the endosperm. The endosperm is the nutritive tissue that provides food for the developing embryo, ensuring the survival and growth of the next generation.

13. Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.

A diagram of a mature, 8-nucleate embryo sac would show an oval structure with two distinct ends.

1. **Micropylar End:** This end has the **egg apparatus**, which consists of one large central **egg cell** and two flanking **synergid cells**. The synergids have filiform apparatus at their base.

2. **Chalazal End:** This end contains three **antipodal cells**.

3. **Center:** The large **central cell** is in the middle, containing two **polar nuclei**.



Chapter 3: Reproductive Health

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. What is a state of total well-being in all aspects of reproduction called?
- **Reproductive health.**
2. What major problem arises from a rapid increase in population?
- **Overpopulation, leading to scarcity of resources.**
3. What day is celebrated as World Population Day?
- **July 11th.**
4. According to the 2001 census, what was India's population growth rate?
- **Approximately 2%.**
5. What is the legal minimum age for marriage for girls and boys in India?
- **18 years for girls and 21 years for boys.**
6. What are the methods used to prevent unwanted pregnancies called?
- **Contraception or birth control.**
7. How do oral contraceptive pills primarily prevent pregnancy?
- **By inhibiting ovulation and implantation.**
8. What is 'Saheli'?
- **A non-steroidal, 'once-a-week' oral contraceptive pill for females.**
9. What are devices inserted into the uterus to prevent pregnancy called?
- **Intra-Uterine Devices (IUDs).**
10. Which IUD releases hormones?
- **LNG-20 (Progestasert).**
11. How does a Copper-T IUD work?
- **It releases copper ions that suppress sperm motility and fertilizing capacity.**
12. By what primary mechanism does Copper-T prevent pregnancy?
- **It prevents fertilization.**
13. What is the surgical method of contraception in males called?
- **Vasectomy.**
14. What is surgically cut or tied during a vasectomy?
- **The vas deferens.**
15. What is the surgical method of contraception in females called?
- **Tubectomy.**
16. What is surgically cut or tied during a tubectomy?
- **The fallopian tubes.**
17. Are vasectomy and tubectomy temporary or permanent methods of contraception?
- **They are permanent (sterilization) methods.**
18. What does MTP stand for?
- **Medical Termination of Pregnancy.**
19. What is another term for a voluntary or induced abortion?
- **MTP.**
20. Up to how many weeks of pregnancy is MTP considered relatively safe?
- **Up to 12 weeks (the first trimester).**
21. What are diseases transmitted through sexual intercourse called?
- **Sexually Transmitted Diseases (STDs) or Venereal Diseases (VDs).**
22. Name two common bacterial STDs.
- **Syphilis and Gonorrhoea.**
23. What is the causative pathogen for Syphilis?
- **Treponema pallidum.**
24. What is the inability to conceive or produce children called?
- **Infertility.**
25. What do we call the technologies used to help infertile couples have children?
- **Assisted Reproductive Technologies (ART).**
26. What is fertilization that occurs outside the body in a lab setting called?
- **In vitro fertilization (IVF).**
27. A baby conceived through IVF is commonly known as what?
- **A test-tube baby.**
28. What technique involves transferring an embryo (zygote) into the fallopian tube?
- **ZIFT (Zygote Intra-Fallopian Transfer).**
29. At what temperature is semen cryopreserved for long-term storage?
- **In liquid nitrogen (-196°C).**
30. What is the prenatal diagnostic technique used to detect genetic disorders in a fetus?
- **Amniocentesis.**
31. What is analyzed during amniocentesis?
- **The amniotic fluid.**
32. Which condition cannot be detected by amniocentesis?
- **Jaundice.**
33. What is the full form of RCH programs initiated by the government?
- **Reproductive and Child Health Care.**
34. Besides preventing pregnancy, what is another key function of condoms?
- **Protection against Sexually Transmitted Diseases (STDs).**
35. The "rhythm method," based on avoiding intercourse during the fertile period, is what kind of contraception?
- **A natural method.**
36. What is the term for pills taken after unprotected sex to prevent pregnancy?
- **Emergency contraceptives.**
37. What is the full form of AIDS?
- **Acquired Immuno Deficiency Syndrome.**
38. What virus causes AIDS?
- **Human Immunodeficiency Virus (HIV).**
39. Are all STDs completely curable?
- **No, viral STDs like AIDS and Genital Herpes are not completely curable.**
40. What is the full form of GIFT in the context of ART?
- **Gamete Intra-Fallopian Transfer.**
41. What ART involves directly injecting a sperm into an ovum in the laboratory?
- **ICSI (Intracytoplasmic Sperm Injection).**
42. What does the ART technique IUI stand for?
- **Intra-Uterine Insemination.**
43. Why is there a statutory ban on using amniocentesis for sex determination?
- **To prevent female foeticide.**
44. What are the three main categories of contraceptive methods?
- **Natural, Barrier, and Hormonal/Chemical methods.**
45. What is the full form of WHO?
- **World Health Organization.**
46. What is the term for the natural end of the menstrual cycle in women?
- **Menopause.**
47. What is the name for creams, jellies, and foams that kill sperm?
- **Spermicides.**
48. What is the most widely used contraceptive method by males in India?
- **Condoms.**

IMPORTANT QUESTIONS AND ANSWERS

1. Mention the adaptations of wind-pollinated flowers.

Wind-pollinated flowers, or anemophilous flowers, are adapted to increase the chances of pollination without attracting insects. They are typically small and inconspicuous, lacking bright colors, nectar, and fragrance. The pollen grains are produced in very large quantities, are lightweight and non-sticky to be easily carried by wind. The stigma is often large, feathery, and well-exposed to efficiently trap airborne pollen.

2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone is a group of morphologically and genetically identical organisms produced from a single parent through asexual reproduction. A significant **advantage** is the preservation and rapid multiplication of desirable parental traits, such as high yield or disease resistance. A major **disadvantage** is the lack of genetic variation, which makes the entire population equally vulnerable to new diseases or changes in the environment.

3. What are the names of the component cells of the embryo sac?

A mature angiosperm embryo sac typically consists of a seven-celled, eight-nucleate structure. These components are: the **egg apparatus** at the micropylar end (comprising one egg cell and two synergids), three **antipodal cells** at the chalazal end, and one large **central cell** in the middle, which contains two polar nuclei.

4. What do you understand by emasculation? Why is it done?

Emasculation is the surgical removal of anthers from a bisexual flower before the pollen matures, without damaging the female reproductive part (pistil). This technique is a crucial step in artificial hybridization. It is performed to prevent unwanted self-pollination and to allow for controlled cross-pollination with pollen from a desired male parent, which is essential for developing new plant varieties with specific traits.

5. Tell about false fruit with an example.

A false fruit, or pseudocarp, is a fruit that develops from floral parts other than the ovary. While a true fruit develops exclusively from the ovary, in a false fruit, other parts like the thalamus or receptacle grow to become the main fleshy and edible portion. A common example is the apple, where the part we eat is the succulent thalamus, not the ovary.

6. Give the definition of monocarpic fruits with an example.

Monocarpic plants are those that flower, set fruit, and produce seeds only once in their lifetime before dying. The fruits they produce are thus referred to as monocarpic fruits. This strategy involves the plant investing all of its resources into a single, massive reproductive event. Well-known examples of monocarpic plants include bamboo and agave.

7. Explain false fruit with an example.

A false fruit is a fruit in which the fleshy, edible part is derived from tissues other than the ovary, such as the thalamus or receptacle. This is in contrast to a true fruit, which develops solely from the ovary. A well-known example is the strawberry, where the red, fleshy part is the swollen receptacle, and the actual tiny 'seeds' on the surface are the true fruits (achenes).

8. Write a short note on asexual reproduction in organisms.

Asexual reproduction is a mode of reproduction involving a single parent that results in offspring that are genetically identical to the parent, known as clones. This process does not involve the fusion of gametes. It is a common and rapid method of multiplication in many organisms, including single-celled organisms (like bacteria via fission, yeast via budding) and many plants (via vegetative propagation).

9. Explain asexual reproduction in an organism with the help of example.

Asexual reproduction is a method of creating new individuals from a single parent, without the involvement of gametes. The offspring are genetically identical to the parent. For instance, \textit{Hydra} reproduces asexually through budding. A small bud develops as an outgrowth on the parent's body, grows into a miniature hydra, and eventually detaches to lead an independent life.

10. Define the following: (i) Protozoan endoparasite (ii) Ovule

(i) **Protozoan endoparasite:** A single-celled eukaryotic organism (protozoan) that lives inside the body of another organism (the host) and obtains nourishment from it, such as \textit{Plasmodium}, which causes malaria in humans. (ii) **Ovule:** The structure within the ovary of a flowering plant that contains the female gamete (egg cell) and, after fertilization, develops into the seed.

11. Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenogenic fruits (iv) Polyembryony

(i) **False Fruit:** A fruit developing from floral parts besides the ovary. Example: Apple. (ii) **True Fruit:** A fruit developing solely from the ovary. Example: Mango. (iii) **Parthenocarpic Fruit:** A fruit that develops without fertilization, and is thus seedless. Example: Banana. (iv) **Polyembryony:** The occurrence of more than one embryo in a single seed. Example: Citrus.

12. What is the importance of embryosac in angiospermic plants?

The embryo sac is fundamentally important in angiosperms as it is the site of fertilization. It contains the female gamete (egg cell) which fuses with a male gamete to form the zygote. It also houses the polar nuclei, which fuse with the second male gamete to form the primary endosperm nucleus, giving rise to the endosperm. The endosperm provides the vital nutrition required for the development of the embryo.

13. Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.

A diagram of a mature embryo sac shows an oval structure containing: at the micropylar end, an **egg apparatus** (one egg cell and two synergids with filiform apparatus); at the chalazal end, three **antipodal cells**; and in the center, a large **central cell** with two polar nuclei.

14. Define cross-pollination with the help of suitable example.

Cross-pollination, or xenogamy, is the transfer of pollen grains from the anther of a flower on one plant to the stigma of a flower on a different plant of the same species. It is crucial for promoting genetic diversity. A suitable example is maize, which is monoecious but relies on wind to carry pollen from the tassel (male flower) of one plant to the silk (stigma) of another.

15. What do you understand by parthenogenesis ? Explain with example.

Parthenogenesis is a natural form of asexual reproduction where an embryo develops from an unfertilized ovum. This process leads to the development of an individual without fertilization. For example, in honeybees, the male drones are produced from unfertilized, haploid eggs laid by the queen bee, while the female bees develop from fertilized eggs.

16. Describe the structure of microsporangium.

A typical microsporangium (pollen sac) has a circular structure surrounded by four protective wall layers: the outermost **epidermis**, followed by the **endothecium**, one to three **middle layers**, and the innermost nutritive layer called the **tapetum**. The center of the microsporangium is filled with sporogenous tissue, whose cells develop into pollen grains.



Chapter 4: Principles of Inheritance and Variation

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Who is known as the Father of Genetics? - **Gregor Mendel.**
2. What plant did Mendel choose for his experiments? - **The garden pea (*Pisum sativum*).**
3. How many pairs of contrasting traits did Mendel study in pea plants? - **Seven.**
4. The basic units of heredity, which Mendel called 'factors', are now known as what? - **Genes.**
5. What are the alternative forms of a gene called? - **Alleles.**
6. Who first proposed the 'Genotype-Phenotype' concept? - **Wilhelm Johannsen.**
7. Which of Mendel's laws states that in a heterozygous pair, one allele expresses itself over the other? - **The Law of Dominance.**
8. Which of Mendel's laws states that alleles for a trait separate during gamete formation? - **The Law of Segregation.**
9. The Law of Segregation is also known as what? - **The Law of Purity of Gametes.**
10. Which two laws of inheritance were derived from the monohybrid cross? - **The Law of Dominance and the Law of Segregation.**
11. What is the phenotypic ratio of a typical monohybrid cross in the F₂ generation? - **3:1.**
12. What is the genotypic ratio of a typical monohybrid cross in the F₂ generation? - **1:2:1.**
13. Which of Mendel's laws is based on the dihybrid cross? - **The Law of Independent Assortment.**
14. What is the phenotypic ratio of a typical dihybrid cross in the F₂ generation? - **9:3:3:1.**
15. What phenomenon occurs when the F₁ generation has a phenotype intermediate between the two parents? - **Incomplete Dominance.**
16. The pink flowers from a cross between red and white-flowered Antirrhinum plants is an example of what? - **Incomplete Dominance.**
17. What is the phenotypic ratio in the F₂ generation for incomplete dominance? - **1:2:1.**
18. What phenomenon occurs when both alleles in a heterozygote express themselves fully? - **Codominance.**
19. Human ABO blood groups are a classic example of which two genetic principles? - **Codominance and Multiple Allelism.**
20. What is it called when a gene exists in more than two allelic forms? - **Multiple Allelism.**
21. Which blood group is the universal donor? - **Blood group O.**
22. Which blood group has no antigens on its red blood cells? - **Blood group O.**
23. Which blood group has no antibodies in its plasma? - **Blood group AB.**
24. If a child has blood group 'O' and the father has 'B', what must the father's genotype be? - **I^Bi (heterozygous).**
25. What is it called when a single gene influences multiple phenotypic traits? - **Pleiotropy.**
26. Sickle-cell anemia is a classic example of which genetic phenomenon? - **Pleiotropy.**
27. Who proposed the Chromosomal Theory of Inheritance? - **Sutton and Boveri.**
28. The physical exchange of genetic material between homologous chromosomes is called what? - **Crossing over.**
29. In which stage of meiosis does crossing over occur? - **Pachytene.**
30. The tendency of genes on the same chromosome to be inherited together is called what? - **Linkage.**
31. Linkage is considered an exception to which of Mendel's laws? - **The Law of Independent Assortment.**
32. The number of linkage groups in an organism is equal to what? - **Its haploid number of chromosomes (n).**
33. If an organism has 2n=14 chromosomes, how many linkage groups does it have? - **Seven.**
34. Who created the first recombination maps of chromosomes? - **Alfred Sturtevant.**
35. What is the phenomenon where one gene pair masks the effect of a non-allelic gene pair? - **Epistasis.**
36. What are the sex chromosomes in a human male? - **XY.**
37. What are the sex chromosomes in a human female? - **XX.**
38. Which chromosome determines maleness in humans? - **The Y-chromosome.**
39. In birds, which sex is heterogametic (produces two different types of gametes)? - **The female (ZW).**
40. The gene for hypertrichosis (hair on ears) is located on which chromosome? - **The Y-chromosome.**
41. What is a sudden, heritable change in the genetic material called? - **A mutation.**
42. What is a disease present from birth called? - **A congenital disease.**
43. Haemophilia is what type of genetic disorder? - **An X-linked recessive disorder.**
44. Why is Haemophilia also called "Bleeder's disease"? - **Because it impairs the body's ability to form blood clots.**
45. A person with color blindness cannot distinguish between which two colors? - **Red and green.**
46. Sickle-cell anemia is what type of genetic disorder? - **An autosomal recessive disorder.**
47. Which disease is caused by a defect in hemoglobin? - **Sickle-cell anemia.**
48. What is any change in the number or structure of chromosomes called? - **A chromosomal aberration.**
49. What is the condition of having an abnormal number of chromosomes (e.g., 2n±1, 2n±2) called? - **Aneuploidy.**
50. What is the trisomy of the 21st chromosome known as? - **Down's syndrome.**

IMPORTANT QUESTIONS AND ANSWERS

1. **Mention the adaptations of wind-pollinated flowers.**
Wind-pollinated flowers are typically small, colourless, and nectarless. They produce large quantities of lightweight, non-sticky pollen and have large, feathery stigmas to effectively trap airborne pollen.
2. **Define a clone. Write about one advantage and one disadvantage of a clone.**
A clone refers to organisms that are genetically identical, produced from a single parent by asexual reproduction. The main advantage is the preservation of desirable parental traits. The main disadvantage is the lack of genetic variation, making the population vulnerable to diseases.
3. **What are the names of the component cells of the embryo sac?**
A mature embryo sac contains an egg apparatus (one egg cell and two synergids), three antipodal cells, and a large central cell with two polar nuclei.
4. **What do you understand by emasculation? Why is it done?**
Emasculation is the removal of anthers from a bisexual flower to prevent self-pollination. It is a key step in artificial hybridization to ensure controlled cross-pollination with pollen from a desired plant.
5. **Tell about false fruit with an example.**
A false fruit develops from floral parts other than the ovary, such as the thalamus. A common example is the apple, where the fleshy, edible portion is the swollen thalamus.
6. **Give the definition of monocarpic fruits with an example.**
Monocarpic plants flower and produce fruit only once in their lifetime before dying. The fruits they produce are called monocarpic fruits. Examples include bamboo and agave.
7. **Explain false fruit with an example.**
A false fruit is one where the main fleshy part develops from tissues other than the ovary, like the receptacle. A well-known example is the strawberry, where the fleshy part is the receptacle and the true fruits are the tiny achenes on its surface.
8. **Write a short note on asexual reproduction in organisms.**
Asexual reproduction involves a single parent giving rise to offspring that are genetically identical (clones). This process does not involve the fusion of gametes and is a rapid method of multiplication seen in organisms like bacteria (fission) and yeast (budding).
9. **Explain asexual reproduction in an organism with the help of example.**
Asexual reproduction produces offspring from a single parent without gamete fusion, creating genetically identical individuals. For example, Hydra reproduces by budding, where a new individual grows as an outgrowth on the parent's body and then detaches.
10. **Define the following: (i) Protozoan endoparasite (ii) Ovule**
(i) A protozoan endoparasite is a single-celled eukaryote living inside a host, like *Plasmodium* which causes malaria. (ii) An ovule is the structure in a plant's ovary containing the female gamete, which develops into a seed after fertilization.
11. **Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenocarpic fruits (iv) Polyembryony**
(i) False Fruit: Develops from parts other than the ovary; e.g., Apple.
(ii) True Fruit: Develops solely from the ovary; e.g., Mango.
(iii) Parthenocarpic Fruit: Develops without fertilization; e.g., Banana.
(iv) Polyembryony: Presence of multiple embryos in one seed; e.g., Citrus.
12. **What is the importance of embryosac in angiospermic plants?**
The embryo sac is vital as it contains the egg cell for forming the zygote and the polar nuclei for forming the nutritive endosperm after fertilization. This ensures both the creation and nourishment of the embryo.
13. **Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.**
A diagram would show an oval embryo sac with the egg apparatus (one egg cell, two synergids) at the micropylar end, three antipodal cells at the chalazal end, and a central cell with two polar nuclei.
14. **Define cross-pollination with the help of suitable example.**
Cross-pollination is the transfer of pollen from the anther of one plant to the stigma of another plant. It promotes genetic diversity. For instance, dioecious plants like papaya depend on it for reproduction.
15. **What do you understand by parthenogenesis ? Explain with example.**
Parthenogenesis is the development of an embryo from an unfertilized egg. A common example is in honeybees, where male drones develop from unfertilized eggs and are haploid.
16. **Describe the structure of microsporangium.**
A microsporangium (pollen sac) is surrounded by four wall layers: the epidermis, endothecium, middle layers, and the nutritive tapetum. Its center contains sporogenous tissue that forms pollen grains.
17. **Explain double fertilization.**
Double fertilization is a process in angiosperms where one male gamete fuses with the egg to form a diploid ($2n$) zygote, and a second male gamete fuses with the two polar nuclei to form a triploid ($3n$) primary endosperm nucleus.
18. **What is double fertilisation? in which plant group does it occur?**
Double fertilization involves two fusions: one male gamete with the egg to form a zygote, and a second with the polar nuclei to form the endosperm. This unique process occurs only in angiosperms (flowering plants).
19. **What is polyembryony? Give example.**
Polyembryony is the condition of having more than one embryo in a single seed. It is commonly observed in citrus fruits like oranges and lemons.



Chapter 5: Molecular Basis of Inheritance

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Polymers of nucleotides are called?
- **Nucleic acids (DNA and RNA).**
2. The three components of a nucleotide?
- **A pentose sugar, a nitrogenous base, and a phosphate group.**
3. The two components of a nucleoside?
- **A pentose sugar and a nitrogenous base.**
4. Pentose sugar found in DNA?
- **Deoxyribose.**
5. Pentose sugar found in RNA?
- **Ribose.**
6. The two types of nitrogenous bases? - **Purines and Pyrimidines.**
7. Which nitrogenous bases are purines?
- **Adenine (A) and Guanine (G).**
8. Pyrimidine bases in DNA?
- **Thymine (T) and Cytosine (C).**
9. Pyrimidine bases in RNA?
- **Uracil (U) and Cytosine (C).**
10. Base present in RNA but not DNA?
- **Uracil (U).**
11. Base present in DNA but not RNA?
- **Thymine (T).**
12. Who provided DNA's X-ray diffraction data?
- **Maurice Wilkins and Rosalind Franklin.**
13. Who proposed the double helix model of DNA?
- **Watson and Crick.**
14. How are the two DNA strands oriented?
- **Antiparallel and complementary.**
15. What bond holds the two DNA strands together?
- **Hydrogen bonds.**
16. In DNA, Adenine (A) always pairs with what?
- **Thymine (T).**
17. Guanine (G) always pairs with what?
- **Cytosine (C).**
18. What is Chargaff's rule?
- **The amount of A equals T, and the amount of G equals C.**
19. If DNA has 18% Cytosine, what is Adenine's percentage?
- **32%.**
20. Why is the distance between DNA strands uniform?
- **Because a purine always pairs with a pyrimidine.**
21. How many base pairs are in one turn of the B-DNA helix?
- **Ten.**
22. Whose experiment demonstrated transformation?
- **Frederick Griffith.**
23. Whose experiment proved DNA is the genetic material?
- **Hershey and Chase.**
24. In the Hershey-Chase experiment, what was the bacteriophage's genetic material?
- **DNA.**
25. The process of making an identical copy of DNA is called?
- **Replication.**
26. In which direction does DNA replication always occur?
- **The 5' to 3' direction.**
27. Why is DNA replication called semi-conservative?
- **Because each new molecule has one old strand and one new strand.**
28. Short DNA fragments on the lagging strand are called?
- **Okazaki fragments.**
29. What is the main enzyme for DNA replication?
- **DNA polymerase.**
30. What is the central dogma of molecular biology?
- **DNA → RNA → Protein.**
31. Synthesizing RNA from a DNA template is called?
- **Transcription.**
32. What is the primary enzyme required for transcription?
- **RNA polymerase.**
33. Where does transcription occur in eukaryotes?
- **In the nucleus.**
34. In eukaryotes, which enzyme transcribes tRNA and 5S rRNA?
- **RNA polymerase III.**
35. The transcriptionally active region of a chromosome is called?
- **Euchromatin.**
36. Non-coding sequences within a eukaryotic gene are called?
- **Introns (or Junk DNA).**
37. The expressed, coding sequences are called?
- **Exons.**
38. The flow of information from RNA back to DNA is called?
- **Reverse transcription.**
39. A three-base mRNA sequence for an amino acid is a?
- **Codon.**
40. How many codons are in the genetic code?
- **64.**
41. What property means one amino acid can have multiple codons?
- **Degeneracy.**
42. What is the universal start codon?
- **AUG.**
43. Name one of the three termination (stop) codons.
- **UAA (or UAG, UGA).**
44. What property means the genetic code is read without punctuation?
- **It is commaless.**
45. Who proposed the 'One gene, one enzyme' hypothesis?
- **Beadle and Tatum.**
46. Synthesizing a protein from an mRNA template is called?
- **Translation.**
47. Which RNA carries an amino acid to the ribosome?
- **Transfer RNA (tRNA).**
48. What is the three-base sequence on tRNA called?
- **An anticodon.**
49. What does the "charging" of tRNA refer to?
- **The linking of an amino acid to its corresponding tRNA.**
50. A unit of gene regulation in prokaryotes is called?
- **An operon.**
51. Who proposed the lac operon model?
- **Jacob and Monod.**
52. The operon model represents what process?
- **Gene regulation.**
53. In the lac operon, what does the 'y' gene code for?
- **Permease.**
54. Where does the repressor protein bind in the lac operon?
- **To the operator region.**
55. Mobile genetic elements are called?
- **Transposons.**
56. The human chromosome with the most genes? The fewest?
- **Chromosome 1 (most) and Chromosome Y (fewest).**
57. Who initially developed DNA fingerprinting?
- **Alec Jeffreys.**
58. What is the technical basis of DNA fingerprinting?
- **Polymorphism in DNA sequences.**

IMPORTANT QUESTIONS AND ANSWERS

1. Mention the adaptations of wind-pollinated flowers.

Wind-pollinated flowers are typically small, inconspicuous, and lack nectar or fragrance. They produce large quantities of lightweight, non-sticky pollen to be easily carried by wind, and their stigmas are often large and feathery to effectively trap this airborne pollen.

2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone is a group of genetically identical organisms produced from a single parent via asexual reproduction. An advantage is the rapid multiplication and preservation of desirable parental traits. The main disadvantage is the lack of genetic variation, making the entire population susceptible to the same diseases or environmental stresses.

3. What are the names of the component cells of the embryo sac?

A mature embryo sac contains an egg apparatus (one egg cell and two synergids), three antipodal cells, and a large central cell that houses two polar nuclei. This makes it a 7-celled, 8-nucleate structure.

4. What do you understand by emasculation? Why is it done?

Emasculation is the removal of anthers from a bisexual flower before they mature. This is a key step in artificial hybridization, performed to prevent unwanted self-pollination and to ensure that the flower is cross-pollinated only with desired pollen grains.

5. Tell about false fruit with an example.

A false fruit (or pseudocarp) is one that develops from floral parts other than the ovary, such as the thalamus. A classic example is the apple, where the fleshy, edible portion is the swollen thalamus, not the ovary.

6. Give the definition of monocarpic fruits with an example.

Monocarpic fruits are produced by plants that flower and fruit only once in their entire lifetime before dying. This reproductive strategy is seen in plants like bamboo and agave, which channel all their resources into a single reproductive event.

7. Explain false fruit with an example.

A false fruit is one where the main fleshy part is derived from tissues other than the ovary, like the thalamus or receptacle. For example, in a strawberry, the red edible part is the swollen receptacle, while the true fruits are the tiny achenes on its surface.

8. Write a short note on asexual reproduction in organisms.

Asexual reproduction is a method of reproduction involving a single parent, resulting in offspring that are genetically identical clones. It does not involve the fusion of gametes and is a rapid form of multiplication common in simpler organisms and plants, using methods like fission, budding, and vegetative propagation.

9. Explain asexual reproduction in an organism with the help of example.

Asexual reproduction is the creation of new individuals from a single parent, without gamete fusion. The offspring are genetically identical to the parent. For instance, *Hydra* reproduces asexually through budding, where a small outgrowth develops on the parent, matures, and eventually detaches as a new organism.

10. Define the following: (i) Protozoan endoparasite (ii) Ovule

(i) **Protozoan endoparasite:** A single-celled eukaryotic parasite living inside its host's body, such as *Plasmodium* which causes malaria. (ii) **Ovule:** The structure within a plant's ovary that contains the female gamete and develops into a seed after fertilization.

11. Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenocarpic fruits (iv) Polyembryony

(i) **False Fruit:** Develops from parts other than the ovary; Example: Apple. (ii) **True Fruit:** Develops only from the ovary; Example: Mango. (iii) **Parthenocarpic Fruit:** Develops without fertilization, hence seedless; Example: Banana. (iv) **Polyembryony:** Presence of multiple embryos in one seed; Example: Citrus.

12. What is the importance of embryosac in angiospermic plants?

The embryo sac is vital for sexual reproduction in angiosperms. It contains the egg cell for forming the zygote and the polar nuclei for forming the nutritive endosperm after fertilization, which is essential for nourishing the developing embryo.

13. Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.

A diagram would show an oval structure with the **egg apparatus** (one egg cell, two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and a large **central cell** containing two **polar nuclei**.

14. Define cross-pollination with the help of suitable example.

Cross-pollination is the transfer of pollen from the anther of one plant to the stigma of a different plant of the same species, which promotes genetic variation. For example, papaya plants are dioecious and depend on agents like wind or insects for cross-pollination.

15. What do you understand by parthenogenesis ? Explain with example.

Parthenogenesis is a form of asexual reproduction where an embryo develops from an unfertilized egg. A prime example is in honey bees, where unfertilized eggs develop into haploid male drones.

16. Describe the structure of microsporangium.

A microsporangium is typically surrounded by four wall layers: the epidermis, endothecium, middle layers, and the inner, nutritive tapetum. Its center contains the sporogenous tissue, from which pollen grains are formed.

17. Explain double fertilization.

Double fertilization is unique to angiosperms and involves two fusions. One male gamete fuses with the egg to form a diploid ($2n$) zygote, while the second male gamete fuses with the two polar nuclei to form a triploid ($3n$) primary endosperm nucleus.

18. What is double fertilisation? in which plant group does it occur?

Double fertilization is a reproductive process involving two fusions: one male gamete with the egg (forming the zygote) and the second with the polar nuclei (forming the endosperm). This process occurs exclusively in the plant group **angiosperms** (flowering plants).

19. What is polyembryony? Give example.

Polyembryony is the condition where more than one embryo is found within a single seed. This phenomenon occurs naturally in plants like **citrus** and mango, often resulting in multiple seedlings from one seed.



Chapter 6: Evolution

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Who proposed that life originated from pre-existing non-living organic molecules?
- **Oparin and Haldane.**
2. Whose experiment simulated early Earth conditions to test the theory of chemical evolution?
- **S.L. Miller.**
3. What critical gas was absent from the atmosphere in Miller's experiment?
- **Oxygen (O₂).**
4. The gradual change in life forms over millions of years is called?
- **Evolution (or organic evolution).**
5. Evidence for evolution based on the study of fossils is called?
- **Paleontological evidence.**
6. In which type of rock are fossils generally found?
- **Sedimentary rocks.**
7. Organs with the same basic structure but different functions are called?
- **Homologous organs.**
8. The forelimbs of humans and the wings of birds are examples of what?
- **Homologous organs.**
9. Homologous structures suggest what type of evolution?
- **Divergent evolution.**
10. Organs with different structures but similar functions are called?
- **Analogous organs.**
11. The wings of insects and the wings of birds are examples of what?
- **Analogous organs.**
12. Analogous structures suggest what type of evolution?
- **Convergent evolution.**
13. Who proposed the Law of Embryonic Development (Ontogeny recapitulates phylogeny)?
- **Ernst Haeckel (popularized), but based on Von Baer's laws.**
14. The reappearance of an ancestral trait in an organism is called?
- **Atavism.**
15. A living organism that shows characteristics of two different groups is called a?
- **Connecting link.**
16. Echidna is a connecting link between which two groups?
- **Reptiles and Mammals.**
17. Peripatus is a connecting link between which two phyla?
- **Annelida and Arthropoda.**
18. Archaeopteryx is a fossil connecting link between which two groups?
- **Reptiles and Birds.**
19. Archaeopteryx fossils are from which geological period?
- **The Jurassic period.**
20. Who proposed the theory of "Inheritance of Acquired Characters"?
- **Jean-Baptiste Lamarck.**
21. Who proposed the theory of "Natural Selection"?
- **Charles Darwin.**
22. The appearance of antibiotic-resistant bacteria is an example of evolution by?
- **Natural selection acting on pre-existing variation.**
23. The process where different species evolve from a common ancestor in a specific area is called?
- **Adaptive radiation.**
24. The evolution of Australian marsupials is a prime example of what?
- **Adaptive radiation.**
25. Who proposed the "Theory of Mutation"?
- **Hugo de Vries.**
26. Sudden, large-scale mutations leading to speciation were termed what by de Vries?
- **Salutation.**
27. What is the main source of variation for evolution?
- **Mutation.**
28. Random changes in allele frequencies in a small population are known as what?
- **Genetic drift.**
29. A change in allele frequency when a few individuals establish a new population is called?
- **The Founder Effect.**
30. What is a key factor in the formation of new species by preventing gene flow?
- **Isolation (Reproductive isolation).**
31. The Devonian period is known as the "Age of ___"?
- **Fishes.**
32. Which early hominid was considered more similar to an ape?
- **Dryopithecus.**
33. Prehistoric cave art is estimated to have first appeared around when?
- **18,000 years ago.**
34. Which plant group is known as the "amphibians of the plant kingdom"?
- **Bryophytes.**
35. Who is a famous paleontologist from India?
- **Birbal Sahni.**
36. Euglena is considered a connecting link between which two kingdoms?
- **Plants and Animals.**
37. What are the two key concepts of Darwin's theory of evolution?
- **Branching Descent and Natural Selection.**
38. What phrase describes the reproductive success of an organism in Darwinian terms?
- **Survival of the Fittest.**
39. What principle describes the condition of a non-evolving population's gene pool?
- **The Hardy-Weinberg principle.**
40. What is the transfer of genetic material from one population to another called?
- **Gene flow or gene migration.**
41. Organs that are reduced and non-functional but were functional in ancestors are called?
- **Vestigial organs.**
42. Give a common example of a vestigial organ in humans.
- **The appendix or wisdom teeth.**
43. Which fossil man was the first to make and use stone tools, earning the name 'Handy Man'?
- **Homo habilis.**
44. Which human ancestor first controlled fire?
- **Homo erectus.**
45. The hominid species that lived in caves and were the first to bury their dead was?
- **Neanderthal Man (Homo neanderthalensis).**
46. What is the scientific name for modern man?
- **Homo sapiens.**
47. The different beaks of finches on the Galapagos Islands are a classic example of what?
- **Adaptive radiation.**
48. The evolutionary process by which new biological species arise is called?
- **Speciation.**
49. What type of selection favors the average phenotype and selects against extremes?
- **Stabilizing selection.**
50. The evolution of industrial melanism in peppered moths is a classic example of what?
- **Directional selection.**

IMPORTANT QUESTIONS AND ANSWERS

1. **Mention the adaptations of wind-pollinated flowers.**
Wind-pollinated flowers are typically small, inconspicuous, and lack nectar or fragrance. They produce large quantities of lightweight, non-sticky pollen to ensure distribution by wind. Their stigmas are often large and feathery to effectively trap the airborne pollen.
2. **Define a clone. Write about one advantage and one disadvantage of a clone.**
A clone is a group of genetically identical organisms produced from a single parent via asexual reproduction. An advantage is the rapid preservation of desirable parental traits. A key disadvantage is the lack of genetic variation, making the entire population susceptible to the same diseases or environmental stresses.
3. **What are the names of the component cells of the embryo sac?**
A mature angiosperm embryo sac contains an egg apparatus (one egg cell and two synergids) at the micropylar end, three antipodal cells at the chalazal end, and a large central cell containing two polar nuclei.
4. **What do you understand by emasculation? Why is it done?**
Emasculation is the removal of anthers from a bisexual flower before they mature. It is a key step in artificial hybridization used to prevent self-pollination and allow for controlled cross-pollination with pollen from a desired plant.
5. **Tell about false fruit with an example.**
A false fruit (or pseudocarp) is a fruit that develops from floral parts other than the ovary, such as the thalamus. A classic example is the apple, where the main edible portion is the fleshy thalamus that grows around the true fruit (the core).
6. **Give the definition of monocarpic fruits with an example.**
Monocarpic plants are those that flower, produce fruit, and set seed only once in their entire lifetime before dying. The fruits they bear are called monocarpic fruits. Well-known examples of such plants include bamboo and agave.
7. **Explain false fruit with an example.**
A false fruit is one where the main fleshy part develops from tissues other than the ovary, such as the receptacle or thalamus. For instance, in a strawberry, the edible red part is the swollen receptacle, and the true fruits are the tiny achenes on its surface.
8. **Write a short note on asexual reproduction in organisms.**
Asexual reproduction is a process involving a single parent that gives rise to offspring which are genetically identical to the parent (clones). It does not involve the fusion of gametes. This is a rapid multiplication method found in many organisms, such as bacteria (fission), yeast (budding), and plants (vegetative propagation).
9. **Explain asexual reproduction in an organism with the help of example.**
Asexual reproduction is the creation of new individuals from a single parent without gamete fusion, producing genetically identical offspring. A common example is budding in *Hydra*, where an outgrowth forms on the parent, develops into a small hydra, and then detaches to live independently.
10. **Define the following: (i) Protozoan endoparasite (ii) Ovule**
(i) **Protozoan endoparasite:** A single-celled eukaryotic parasite living inside its host's body. Example: *Plasmodium*, which causes malaria. (ii) **Ovule:** The structure within a plant's ovary containing the female gamete; it develops into a seed after fertilization.
11. **Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenogenic fruits (iv) Polyembryony**
(i) **False Fruit:** Develops from parts besides the ovary; e.g., Apple.
(ii) **True Fruit:** Develops only from the ovary; e.g., Mango.
(iii) **Parthenocarpic Fruit:** Develops without fertilization, hence seedless; e.g., Banana.
(iv) **Polyembryony:** Presence of multiple embryos in one seed; e.g., Citrus.
12. **What is the importance of embryosac in angiospermic plants?**
The embryo sac is vital for sexual reproduction in angiosperms. It contains the egg cell, which upon fertilization forms the zygote, and the polar nuclei, which form the nutritive endosperm. The endosperm provides essential food for the developing embryo.
13. **Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.**
A diagram would show an oval embryo sac with an **egg apparatus** (one egg cell, two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and a large **central cell** containing two **polar nuclei**.
14. **Define cross-pollination with the help of suitable example.**
Cross-pollination is the transfer of pollen from the anther of one plant to the stigma of a genetically different plant of the same species, which promotes genetic variation. For example, maize relies on wind for cross-pollination between different plants.
15. **What do you understand by parthenogenesis ? Explain with example.**
Parthenogenesis is a form of asexual reproduction where an embryo develops from an unfertilized egg. A classic example is in honeybees, where the male drones are produced from unfertilized, haploid eggs.
16. **Describe the structure of microsporangium.**
A microsporangium (pollen sac) is surrounded by four wall layers: the epidermis, endothecium, middle layers, and the inner nutritive tapetum. The center is filled with sporogenous tissue that produces the pollen grains.
17. **Explain double fertilization.**
Double fertilization is a key feature of angiosperms involving two fusion events: one male gamete fuses with the egg to form the diploid ($2n$) zygote, while the second male gamete fuses with the two polar nuclei to form the triploid ($3n$) primary endosperm nucleus.
18. **What is double fertilisation? in which plant group does it occur?**
Double fertilization is a reproductive process involving two fusions: syngamy (male gamete + egg \rightarrow zygote) and triple fusion (male gamete + polar nuclei \rightarrow endosperm). This process is unique to **angiosperms** (flowering plants).
19. **What is polyembryony? Give example.**
Polyembryony is the condition where more than one embryo is present within a single seed. It occurs naturally in many species, with a common example being **Citrus** fruits like oranges and lemons.



Chapter 7: Human Health and Disease

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. What is a disease-causing organism called? **- A pathogen.**
2. Which diagnostic test is used to confirm Typhoid? **- The Widal test.**
3. What is the pathogen that causes Typhoid fever? **- The bacterium *Salmonella typhi*.**
4. What virus causes the common cold? **- Rhinovirus.**
5. Diphtheria is caused by a pathogen from which group? **- Bacteria.**
6. The BCG vaccine is administered to prevent which disease? **- Tuberculosis (TB).**
7. Tuberculosis is primarily transmitted through what medium? **- The air.**
8. Which mosquito is the vector for malaria? **- The female *Anopheles mosquito*.**
9. What is the infective stage of the malarial parasite (Plasmodium) for humans? **- The sporozoite.**
10. Amoebiasis (amoebic dysentery) is caused by which pathogen? **- The protozoan *Entamoeba histolytica*.**
11. The disease Filariasis (Elephantiasis) is caused by what? **- The helminth worm *Wuchereria bancrofti*.**
12. Rabies is caused by which type of pathogen? **- A virus.**
13. Chickenpox is caused by which virus? **- The Varicella-zoster virus.**
14. Which of these is a viral disease: Tetanus, Rabies, or Kala-azar? **- Rabies.**
15. Which of these is a bacterial disease: Mumps, Diphtheria, or Measles? **- Diphtheria.**
16. The body's ability to fight disease-causing organisms is called? **- Immunity.**
17. A foreign substance that elicits an immune response is called an? **- Antigen.**
18. Y-shaped proteins produced in response to antigens are called? **- Antibodies.**
19. Human antibodies are made of what type of molecule? **- Glycoproteins.**
20. The immunity present from birth is called? **- Innate immunity.**
21. Immunity acquired after birth is called? **- Acquired immunity.**
22. Who discovered the principle of passive immunity? **- Emil von Behring.**
23. The first milk produced by a mother, rich in antibodies, is called? **- Colostrum.**
24. Which antibody is abundantly found in colostrum? **- IgA.**
25. What are the two types of lymphocytes? **- B-lymphocytes and T-lymphocytes.**
26. Where are B-lymphocytes and T-lymphocytes produced? **- In the bone marrow.**
27. Where do T-lymphocytes mature? **- In the thymus.**
28. Which cells differentiate into plasma cells to produce antibodies? **- B-lymphocytes.**
29. Rejection of a transplanted organ is primarily due to which cells? **- Cytotoxic T-cells.**
30. The process of introducing a weakened pathogen to stimulate immunity is called? **- Vaccination.**
31. The DPT vaccine ("Triple antigen") protects against Diphtheria, Pertussis, and what else? **- Tetanus.**
32. The DPT vaccine is NOT used for which disease: Diphtheria, Typhoid, or Tetanus? **- Typhoid.**
33. An exaggerated immune response to certain environmental antigens is called an? **- Allergy.**
34. Which antibody type is associated with allergic reactions? **- IgE.**
35. Which chemicals are released from mast cells during an allergic reaction? **- Histamine and Serotonin.**
36. Hay fever is a common disease caused by what? **- Allergens.**
37. A disease where the body's immune system attacks its own cells is called an? **- Autoimmune disease.**
38. Rheumatoid arthritis is an example of what type of disease? **- An autoimmune disease.**
39. What does the acronym AIDS stand for? **- Acquired Immuno Deficiency Syndrome.**
40. What is the causative agent of AIDS? **- Human Immunodeficiency Virus (HIV).**
41. What type of virus is HIV? **- A retrovirus.**
42. Which specific cells does HIV primarily attack and destroy? **- Helper T-cells.**
43. Which screening test is widely used for detecting AIDS? **- ELISA (Enzyme-Linked Immunosorbent Assay).**
44. The study of cancer is called? **- Oncology.**
45. Genes that can cause cancer are called? **- Oncogenes.**
46. The spread of malignant tumor cells to distant sites is called? **- Metastasis.**
47. Which of the following is a non-infectious disease: AIDS, Malaria, or Cancer? **- Cancer.**
48. From which plant is opium obtained? **- Papaver somniferum (the poppy plant).**
49. Diacetylmorphine is commonly known as what? **- Heroin.**
50. Morphine is classified as what type of drug? **- An opiate narcotic.**
51. What are the main physiological effects of tobacco use due to nicotine? **- Increased heart rate and blood pressure.**
52. Which organ is most affected by excessive alcohol consumption? **- The liver.**
53. What is the study of viruses called? **- Virology.**
54. A virus is fundamentally composed of what two things? **- Protein and nucleic acid.**

IMPORTANT QUESTIONS AND ANSWERS

1. **Mention the adaptations of wind-pollinated flowers.**
Wind-pollinated flowers are typically small, inconspicuous, and lack nectar and fragrance. They produce enormous amounts of lightweight, non-sticky pollen to ensure distribution by wind. Their stigmas are often large and feathery to effectively trap the airborne pollen grains.
2. **Define a clone. Write about one advantage and one disadvantage of a clone.**
A clone is a group of genetically identical organisms produced from a single parent via asexual reproduction. An **advantage** is the rapid multiplication and preservation of desirable parental traits. A major **disadvantage** is the lack of genetic variation, making the entire population vulnerable to the same diseases or environmental stresses.
3. **What are the names of the component cells of the embryo sac?**
A mature embryo sac contains seven cells: an **egg apparatus** (one egg cell and two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and one large **central cell** in the middle that contains two polar nuclei.
4. **What do you understand by emasculation? Why is it done?**
Emasculation is the removal of anthers from a bisexual flower before they mature. This technique is a key step in artificial hybridization programs, performed to prevent unwanted self-pollination and to allow for controlled cross-pollination with pollen from a desired parent plant.
5. **Tell about false fruit with an example.**
A false fruit (or pseudocarp) is a fruit that develops from floral parts in addition to the ovary, such as the thalamus. In these fruits, the main edible portion is not derived from the ovary. A classic example is the apple, where the fleshy part we eat is the swollen thalamus.
6. **Give the definition of monocarpic fruits with an example.**
Monocarpic fruits are produced by plants that flower and fruit only once in their entire lifetime before dying. These plants, like bamboo and agave, channel all their resources into a single reproductive event. The fruits are the result of this final reproductive phase.
7. **Explain false fruit with an example.**
A false fruit is one where the fleshy, edible portion develops from tissues other than the ovary, such as the receptacle or thalamus. In contrast, a true fruit develops only from the ovary. A well-known example is the strawberry, where the fleshy red part is the receptacle.
8. **Write a short note on asexual reproduction in organisms.**
Asexual reproduction is a mode of reproduction where offspring arise from a single parent without the fusion of gametes. The resulting offspring, called clones, are genetically identical to the parent. This method allows for rapid multiplication and is common in unicellular organisms and many plants, through processes like fission, budding, and vegetative propagation.
9. **Explain asexual reproduction in an organism with the help of example.**
Asexual reproduction is a process where a single parent produces genetically identical offspring without gamete fusion. For example, *Hydra* reproduces asexually by budding. A small bud grows on the parent's body, develops into a miniature *hydra*, and then detaches to live independently.
10. **Define the following: (i) Protozoan endoparasite (ii) Ovule**
(i) **Protozoan endoparasite:** A single-celled eukaryotic parasite living inside its host's body, such as *Plasmodium* causing malaria. (ii) **Ovule:** The structure within a plant's ovary containing the female gamete, which develops into a seed after fertilization.
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(i) **False Fruit:** Develops from parts other than the ovary; Example: Apple. (ii) **True Fruit:** Develops solely from the ovary; Example: Mango. (iii) **Parthenocarpic Fruit:** Develops without fertilization and is seedless; Example: Banana. (iv) **Polyembryony:** Presence of multiple embryos in one seed; Example: Citrus.
12. **What is the importance of embryo sac in angiospermic plants?**
The embryo sac is vital for sexual reproduction in angiosperms. It contains the egg cell, which upon fertilization forms the zygote, and the polar nuclei, which form the nutritive endosperm. The endosperm provides essential food for the developing embryo, ensuring its survival and growth.
13. **Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.**
A diagram would depict an oval structure with an **egg apparatus** (one egg cell and two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and a large **central cell** containing two **polar nuclei**.
14. **Define cross-pollination with the help of suitable example.**
Cross-pollination is the transfer of pollen from the anther of one plant to the stigma of a genetically different plant of the same species. It promotes genetic variation. For instance, papaya plants, being dioecious, depend entirely on agents like wind or insects for cross-pollination.
15. **What do you understand by parthenogenesis ? Explain with example.**
Parthenogenesis is a form of asexual reproduction where an embryo develops from an unfertilized egg. This occurs naturally in several species. A common example is in honeybees, where unfertilized eggs develop into haploid male bees (drones).
16. **Describe the structure of microsporangium.**
A microsporangium (pollen sac) is typically surrounded by four wall layers: the epidermis, endothecium, middle layers, and the nutritive tapetum. The center contains sporogenous tissue, where microspore mother cells undergo meiosis to form pollen grains.
17. **Explain double fertilization.**
Double fertilization, unique to angiosperms, involves two fusion events. First, one male gamete fuses with the egg cell to form the diploid ($2n$) zygote (syngamy). Second, the other male gamete fuses with the two polar nuclei to form the triploid ($3n$) primary endosperm nucleus (triple fusion).
18. **What is double fertilisation? in which plant group does it occur?**
Double fertilization is a complex reproductive process involving two fusions: one male gamete fuses with the egg to form a zygote ($2n$), and the second male gamete fuses with the polar nuclei to create the endosperm ($3n$). This process is a defining characteristic of **angiosperms** (flowering plants).
19. **What is polyembryony? Give example.**
Polyembryony is the condition of having more than one embryo in a single seed. This can result from the cleavage of a zygote or the development of embryos from other cells in the ovule. It is commonly observed in **citrus** fruits and mango.



Chapter 8: Microbes in Human Welfare

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Which bacteria are used to convert milk into curd?
- **Lactic Acid Bacteria (LAB), such as Lactobacillus.**
2. Converting milk to curd increases the content of which vitamin?
- **Vitamin B12.**
3. Which microbe is used to make dough for idli, dosa, and bread?
- **Yeast (specifically Saccharomyces cerevisiae).**
4. The yeast Saccharomyces cerevisiae is commonly known as what?
- **Brewer's yeast.**
5. Yeast is primarily used in the industrial production of what?
- **Ethyl alcohol (ethanol).**
6. How does yeast typically reproduce?
- **Through budding.**
7. Chemicals produced by microbes that can kill or retard the growth of other microbes are called?
- **Antibiotics.**
8. Who discovered the first antibiotic, penicillin?
- **Alexander Fleming.**
9. Fleming discovered penicillin while working on which bacterium?
- **Staphylococcus.**
10. Penicillin is produced by which fungus?
- **The fungus Penicillium notatum.**
11. Who confirmed penicillin's effectiveness as an antibiotic?
- **Ernest Chain and Howard Florey.**
12. The antibiotic cephalosporin is obtained from what type of organism?
- **A fungus.**
13. Which fungus produces citric acid?
- **Aspergillus niger.**
14. Which microbe is used to produce statins?
- **The yeast Monascus purpureus.**
15. What is the primary function of statins?
- **They inhibit cholesterol synthesis.**
16. The enzyme streptokinase is used for what purpose?
- **As a 'clot-buster' for removing clots from blood vessels.**
17. Cyclosporin A is used for what medical purpose?
- **As an immunosuppressant agent in organ transplants.**
18. Municipal wastewater is also known as what?
- **Sewage.**
19. What does BOD stand for?
- **Biochemical Oxygen Demand.**
20. A higher BOD indicates what about a water body?
- **Higher pollution levels.**
21. In sewage treatment, the mesh-like structures of bacteria and fungi are called?
- **Flocs.**
22. The production of biogas involves which group of bacteria?
- **Methanogens.**
23. What is the main component of biogas?
- **Methane (CH₄).**
24. Methanogens produce methane but do NOT produce what gas?
- **Oxygen (O₂).**
25. Microbes used to kill insects and pests are called?
- **Biocontrol agents.**
26. Which bacterium is widely used as a biocontrol agent for insect pests?
- **Bacillus thuringiensis (Bt).**
27. Which free-living fungus is an effective biocontrol agent for plant pathogens?
- **Trichoderma.**
28. Organisms used to enrich the nutrient quality of the soil are called?
- **Biofertilizers.**
29. What is a key characteristic of blue-green algae (cyanobacteria)?
- **Nitrogen fixation.**
30. Rhizobium is a famous bacterium that performs what function?
- **Symbiotic nitrogen fixation.**
31. In which plants are Rhizobium bacteria found?
- **In the root nodules of leguminous plants.**
32. Which cyanobacteria are well-known nitrogen fixers?
- **Anabaena and Nostoc.**
33. Which fungus forms a symbiotic association with plant roots, known as mycorrhiza?
- **Glomus.**
34. The process of preserving liquids by heating and then rapidly cooling is called?
- **Pasteurization.**
35. The practice of farming that avoids the use of chemical fertilizers is called?
- **Organic farming.**
36. Which of these is NOT a biofertilizer: Azotobacter or Bacillus thuringiensis?
- **Bacillus thuringiensis (it is a biocontrol agent).**
37. What are live microbial food supplements called?
- **Probiotics.**
38. Microbes grown for protein-rich food are called?
- **Single Cell Protein (SCP).**
39. Spirulina and Chlorella are examples of what?
- **Single Cell Protein (SCP).**
40. The rearing of honeybees for honey is called?
- **Apiculture or beekeeping.**
41. In a beehive, which bees produce the honey?
- **The worker honeybees.**
42. The rearing of silkworms for silk production is called?
- **Sericulture.**
43. The farming of fish is called?
- **Pisciculture.**
44. The raising of birds like chicken and ducks is called?
- **Poultry farming.**
45. Which of these is NOT considered part of animal husbandry: pisciculture or organic farming?
- **Organic farming.**
46. The cultivation of flowering plants is called?
- **Floriculture.**
47. 'Kalyan Sona' is an improved variety of what crop?
- **Wheat.**
48. A common viral disease in chickens is?
- **Ranikhet disease.**
49. 'Lohi' is a well-known breed of what animal?
- **Sheep.**
50. Which scientist is NOT primarily associated with microbiology: Louis Pasteur or Stephen Hales?
- **Stephen Hales.**
51. What is the scientific term for the rearing of forest trees?
- **Silviculture.**

IMPORTANT QUESTIONS AND ANSWERS

1. Mention the adaptations of wind-pollinated flowers.

Wind-pollinated flowers are typically small, inconspicuous, and lack nectar or fragrance. They produce large quantities of lightweight, non-sticky pollen to be carried by wind. To effectively trap this airborne pollen, their stigmas are often large, feathery, and well-exposed.

2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone is a group of genetically identical organisms produced from a single parent via asexual reproduction. An **advantage** is the rapid multiplication and preservation of desirable parental traits. A major **disadvantage** is the lack of genetic variation, which makes the entire population uniformly susceptible to diseases or environmental changes.

3. What are the names of the component cells of the embryo sac?

A mature angiosperm embryo sac contains: an **egg apparatus** at one end (composed of one egg cell and two synergids), three **antipodal cells** at the opposite end, and one large **central cell** in the middle that contains two polar nuclei.

4. What do you understand by emasculation? Why is it done?

Emasculation is the removal of anthers from a bisexual flower before they mature. It is a key step in artificial hybridization performed to prevent self-pollination, thus allowing for controlled cross-pollination with pollen from a specifically chosen plant.

5. Tell about false fruit with an example.

A false fruit (or pseudocarp) is a fruit where the main fleshy part develops from floral tissues other than the ovary, such as the thalamus. A classic example is the apple, where the edible portion we consume is the swollen, fleshy thalamus.

6. Give the definition of monocarpic fruits with an example.

Monocarpic plants are those that flower, produce fruit, and set seed only once in their lifetime before dying. The fruits they bear are thus called monocarpic fruits. This represents the plant's single, final reproductive effort. Examples include bamboo and agave.

7. Explain false fruit with an example.

A false fruit is one in which the fleshy part is derived from tissues other than the ovary, like the receptacle or thalamus. A common example is the strawberry, where the red, fleshy part is the swollen receptacle, and the true fruits are the tiny achenes on its surface.

8. Write a short note on asexual reproduction in organisms.

Asexual reproduction is a mode of reproduction involving a single parent that produces genetically identical offspring, called clones. It does not involve the fusion of gametes and is a rapid method of multiplication seen in many organisms through processes like budding (yeast), fission (bacteria), and vegetative propagation (plants).

9. Explain asexual reproduction in an organism with the help of example.

Asexual reproduction is the creation of offspring from a single parent without the fusion of gametes, resulting in genetically identical progeny. For example, *Hydra* reproduces asexually by budding, where a new individual develops from an outgrowth on the parent's body and eventually detaches.

10. Define the following: (i) Protozoan endoparasite (ii) Ovule

(i) **Protozoan endoparasite:** A single-celled eukaryotic parasite that lives inside its host's body, such as *Plasmodium*, which causes malaria. (ii) **Ovule:** The structure within a plant's ovary containing the female gamete, which develops into a seed after fertilization.

11. Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenocarpic fruits (iv) Polyembryony

(i) **False Fruit:** Develops from parts besides the ovary; Example: Apple. (ii) **True Fruit:** Develops only from the ovary; Example: Mango. (iii) **Parthenocarpic Fruit:** Develops without fertilization, hence seedless; Example: Banana. (iv) **Polyembryony:** Presence of multiple embryos in one seed; Example: Citrus.

12. What is the importance of embryo sac in angiospermic plants?

The embryo sac is vital for angiosperm reproduction as it contains the egg cell for forming the zygote and the polar nuclei for forming the nutritive endosperm after fertilization. The endosperm provides the food necessary for the embryo's development and survival.

13. Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.

A labelled diagram shows an oval embryo sac containing the **egg apparatus** (one egg cell, two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and a large **central cell** with two **polar nuclei**.

14. Define cross-pollination with the help of suitable example.

Cross-pollination is the transfer of pollen from the anther of one plant to the stigma of a genetically different plant of the same species, which promotes genetic variation. For instance, maize relies on wind for cross-pollination between different plants.

15. What do you understand by parthenogenesis ? Explain with example.

Parthenogenesis is a form of asexual reproduction where an embryo develops from an unfertilized egg. This occurs naturally in some species, such as honey bees, where the male drones develop from unfertilized eggs and are consequently haploid.

16. Describe the structure of microsporangium.

A microsporangium is surrounded by four wall layers: the epidermis, endothecium, middle layers, and the inner, nutritive tapetum. Its center contains the sporogenous tissue, from which microspore mother cells arise and undergo meiosis to form pollen grains.

17. Explain double fertilization.

Double fertilization is unique to angiosperms and involves two fusions. One male gamete fuses with the egg cell to form the diploid ($2n$) zygote. The second male gamete fuses with the two polar nuclei to create the triploid ($3n$) primary endosperm nucleus, which develops into the endosperm.

18. What is double fertilisation? in which plant group does it occur?

Double fertilization involves two fusion events: one male gamete with the egg to form a zygote ($2n$), and the second male gamete with the polar nuclei to form the endosperm ($3n$). This process is a distinctive characteristic of **angiosperms** (flowering plants).

19. What is polyembryony? Give example.

Polyembryony is the condition of having more than one embryo within a single seed. It can occur naturally in various plants, with a common example being **citrus** fruits like oranges and lemons, where multiple seedlings can emerge from one seed.



Chapter 9: Biotechnology: Principles and Processes

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Techniques that use live organisms to produce useful products are called?
- **Biotechnology.**
2. The manipulation of an organism's genes is called?
- **Genetic engineering.**
3. The creation of DNA by combining sequences that wouldn't normally occur together is known as?
- **Recombinant DNA technology.**
4. Enzymes that cut DNA at specific sites are called?
- **Restriction enzymes (endonucleases).**
5. Restriction enzymes are also famously known as what?
- **'Molecular scissors'.**
6. The first restriction endonuclease to be isolated was?
- **Hind II.**
7. Restriction enzymes recognize and cut what specific type of DNA sequence?
- **A palindromic nucleotide sequence.**
8. The restriction enzyme EcoRI is isolated from which bacterium?
- **Escherichia coli (E. coli).**
9. The recognition site for the restriction enzyme EcoRI is?
- **GAATTCT.**
10. Which enzyme is used to join or paste DNA fragments together?
- **DNA ligase.**
11. A DNA molecule used to carry foreign genetic material into another cell is a?
- **Vector.**
12. Small, circular, extrachromosomal DNA molecules found in bacteria are called?
- **Plasmids.**
13. Which feature is NOT part of the pBR322 plasmid: ori, T-DNA, or antibiotic resistance genes?
- **T-DNA.**
14. Which bacterium is known as a "natural genetic engineer" for plants?
- **Agrobacterium tumefaciens.**
15. The tumor-inducing plasmid found in Agrobacterium tumefaciens is called?
- **The Ti-plasmid.**
16. Which of these is NOT a cloning vector for bacteria: Plasmid, Bacteriophage, or T-DNA?
- **T-DNA (used for plants).**
17. To isolate DNA from a bacterial cell, which enzyme is used?
- **Lysozyme.**
18. To isolate DNA from a fungal cell, which enzyme is used?
- **Chitinase.**
19. A technique to separate DNA fragments based on size is called?
- **Gel electrophoresis.**
20. From what is the agarose gel for electrophoresis extracted?
- **Seaweed.**
21. Why do DNA fragments move towards the anode in gel electrophoresis?
- **Because DNA is negatively charged.**
22. What does PCR stand for?
- **Polymerase Chain Reaction.**
23. What is the primary purpose of the PCR technique?
- **DNA amplification (making multiple copies of a gene).**
24. Which heat-stable DNA polymerase is used in PCR?
- **Taq polymerase.**
25. From which bacterium is Taq polymerase isolated?
- **Thermus aquaticus.**
26. Which of these is used to introduce DNA into a host cell: a gene gun or a micropipette?
- **Both can be used.**
27. The method of directly injecting recombinant DNA into an animal cell's nucleus is called?
- **Microinjection.**
28. The biolistic or gene gun method is most suitable for transforming which type of cells?
- **Plant cells.**
29. A gene used to help identify transformed cells is called a?
- **Selectable marker.**
30. In plasmids like pBR322, what is the role of the ampR gene?
- **It provides resistance to the antibiotic ampicillin.**
31. If a foreign gene is inserted into the tetracycline resistance gene, what happens to the recombinant plasmid?
- **It will lose its resistance to tetracycline.**
32. Large vessels used for growing microbes to produce products on a large scale are called?
- **Bioreactors.**
33. The process of growing cells or tissues in a sterile, nutrient-rich medium is called?
- **Tissue culture.**
34. The entire series of processes after the biosynthetic stage to obtain a finished product is called?
- **Downstream processing.**
35. The plasmid from which bacterium was used to construct the first recombinant DNA?
- **Salmonella typhimurium.**
36. Which chemicals are known to induce protoplast fusion?
- **Polyethylene glycol (PEG) and sodium nitrate.**
37. What is the term for enzymes that cut DNA from the ends?
- **Exonucleases.**
38. What is the function of the 'ori' site in a plasmid vector?
- **It is the Origin of Replication, where DNA copying begins.**
39. What are the three main steps of a single PCR cycle?
- **Denaturation, Annealing, and Extension.**
40. What happens during the 'denaturation' step of PCR?
- **The two strands of the DNA helix are separated by heating.**
41. What staining agent is used to visualize DNA in gel electrophoresis?
- **Ethidium bromide.**
42. The process of making a host cell competent to take up foreign DNA is called?
- **Transformation.**
43. What is a DNA probe?
- **A single-stranded DNA or RNA fragment used to detect a specific complementary sequence.**
44. The blotting technique used for transferring DNA from a gel to a membrane is called?
- **Southern Blotting.**
45. To isolate DNA from a plant cell, which enzyme is primarily used?
- **Cellulase.**
46. What type of bioreactor is most commonly used?
- **Stirring-type bioreactor.**

IMPORTANT QUESTIONS AND ANSWERS

1. **Mention the adaptations of wind-pollinated flowers.**
Wind-pollinated flowers are typically small and inconspicuous, lacking nectar and fragrance. They produce enormous quantities of lightweight, non-sticky pollen to increase dispersal by wind. Their stigmas are often large and feathery to effectively trap this airborne pollen.
2. **Define a clone. Write about one advantage and one disadvantage of a clone.**
A clone is a group of genetically identical organisms produced from a single parent via asexual reproduction. An **advantage** is the rapid preservation of desirable parental traits. A major **disadvantage** is the lack of genetic variation, making the entire population susceptible to the same diseases or environmental stresses.
3. **What are the names of the component cells of the embryo sac?**
A mature angiosperm embryo sac contains an **egg apparatus** (one egg cell and two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and one large **central cell** in the middle containing two polar nuclei.
4. **What do you understand by emasculation? Why is it done?**
Emasculation is the removal of anthers from a bisexual flower before they mature to prevent self-pollination. This technique is a crucial step in artificial hybridization programs, as it ensures that the flower can be cross-pollinated with pollen from a specifically chosen male parent to create improved plant varieties.
5. **Tell about false fruit with an example.**
A false fruit (or pseudocarp) is a fruit where the main fleshy part develops from tissues other than the ovary, such as the thalamus. This is unlike a true fruit, which develops solely from the ovary. A classic example is the apple, where the edible portion is the swollen, fleshy thalamus.
6. **Give the definition of monocarpic fruits with an example.**
Monocarpic plants are those that flower, produce fruit, and set seed only once in their entire lifetime before dying. Their fruits are a result of this single reproductive event. Well-known examples of monocarpic plants include bamboo and agave.
7. **Explain false fruit with an example.**
A false fruit is one in which the fleshy part is derived from tissues adjacent to the ovary, such as the thalamus or receptacle. In a true fruit, the flesh develops only from the ovary wall. A common example is the strawberry, where the red fleshy part is the swollen receptacle.
8. **Write a short note on asexual reproduction in organisms.**
Asexual reproduction is a method of reproduction involving a single parent that produces offspring, called clones, which are genetically identical to it. This process does not involve the fusion of gametes and is a rapid form of multiplication. Common methods include fission in bacteria, budding in yeast, and vegetative propagation in plants.
9. **Explain asexual reproduction in an organism with the help of example.**
Asexual reproduction is a process where an organism creates genetically identical offspring from a single parent. For instance, the freshwater organism *Hydra* reproduces asexually through budding. A bud develops as an outgrowth on the parent's body, matures into a miniature hydra, and then detaches to live independently.
10. **Define the following: (i) Protozoan endoparasite (ii) Ovule**
(i) **Protozoan endoparasite:** A single-celled eukaryotic parasite that lives inside its host's body, like *Plasmodium* which causes malaria. (ii) **Ovule:** The structure within a plant's ovary containing the female gamete; after fertilization, it develops into a seed.
11. **Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenogenic fruits (iv) Polyembryony**
(i) **False Fruit:** Develops from parts other than the ovary; Example: Apple. (ii) **True Fruit:** Develops only from the ovary; Example: Mango. (iii) **Parthenocarpic Fruit:** Develops without fertilization and is seedless; Example: Banana. (iv) **Polyembryony:** Presence of more than one embryo in a seed; Example: Citrus.
12. **What is the importance of embryo sac in angiospermic plants?**
The embryo sac is vital for sexual reproduction in angiosperms. It contains the egg cell, which upon fertilization forms the zygote, and the polar nuclei, which form the endosperm. The endosperm then serves as the nutritive tissue for the developing embryo.
13. **Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.**
A diagram shows an oval structure with an **egg apparatus** (one egg, two synergids) at the micropylar end, three **antipodal cells** at the chalazal end, and a large **central cell** with two **polar nuclei**.
14. **Define cross-pollination with the help of suitable example.**
Cross-pollination is the transfer of pollen from the anther of a flower on one plant to the stigma of a flower on a different plant of the same species. This process is essential for genetic variation. For example, papaya plants, being dioecious, depend entirely on cross-pollination by agents like wind or insects.
15. **What do you understand by parthenogenesis ? Explain with example.**
Parthenogenesis is a form of asexual reproduction where an embryo develops from an unfertilized egg. For example, in honeybees, the male drones are produced from the queen's unfertilized haploid eggs, while female workers and queens develop from fertilized diploid eggs.
16. **Describe the structure of microsporangium.**
A microsporangium (pollen sac) is typically surrounded by four wall layers: the epidermis, endothecium, middle layers, and the innermost nutritive tapetum. At its center lies the sporogenous tissue, which contains microspore mother cells that produce pollen grains.
17. **Explain double fertilization.**
Double fertilization, unique to angiosperms, involves two fusions. One male gamete fuses with the egg to form the diploid (\$2n\$) zygote. The second male gamete fuses with the two polar nuclei in the central cell to form the triploid (\$3n\$) primary endosperm nucleus, which nourishes the embryo.
18. **What is double fertilisation? in which plant group does it occur?**
Double fertilization is a complex reproductive process involving two fusions: one male gamete with the egg to form the zygote (\$2n\$), and the second with the two polar nuclei to form the endosperm (\$3n\$). This unique event occurs exclusively in **angiosperms** (flowering plants).
19. **What is polyembryony? Give example.**
Polyembryony is the condition of having more than one embryo in a single seed. It can occur when cells of the nucellus or integuments develop into additional embryos alongside the normal one. A common example is found in **citrus** fruits like oranges and lemons.



Chapter 10: Biotechnology and its Applications

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Plants, bacteria, or animals whose genes have been altered are called?
- **Genetically Modified Organisms (GMOs).**
2. Which bacterium produces a protein that is toxic to certain insects?
- **Bacillus thuringiensis.**
3. The toxic insecticidal protein produced by Bacillus thuringiensis is called?
- **Bt toxin (or Cry protein).**
4. The Bt toxin exists as an inactive protoxin but becomes active at what pH?
- **An alkaline pH (found in the insect's gut).**
5. Which crop is famously protected from bollworms by the Cry gene?
- **Cotton (creating Bt cotton).**
6. The genes crylAc and crylAb control which pest?
- **Cotton bollworms.**
7. The gene crylAb controls which specific pest?
- **The corn borer.**
8. The process of silencing a specific gene using double-stranded RNA is called?
- **RNA interference (RNAi).**
9. RNAi is used to protect which plant from the nematode Meloidogyne incognita?
- **Tobacco.**
10. The nematode Meloidogyne incognita infects which part of the tobacco plant?
- **The roots.**
11. 'Golden Rice' is a transgenic crop developed to be rich in what?
- **Vitamin A (due to B-carotene).**
12. The transgenic tomato variety with a longer shelf life is named what?
- **Flavr Savr.**
13. Human insulin produced using biotechnology is often called?
- **Humulin.**
14. Who first determined the molecular structure of insulin?
- **Frederick Sanger.**
15. Which polypeptide chain is removed from proinsulin to form mature, functional insulin?
- **The C-peptide.**
16. The first clinical gene therapy was performed to treat what deficiency?
- **Adenosine Deaminase (ADA) deficiency, which causes SCID.**
17. The use of molecular biology for medical diagnosis is called?
- **Molecular diagnostics.**
18. Which technique is used for early detection of HIV infection?
- **PCR (Polymerase Chain Reaction).**
19. Which diagnostic test is based on the principle of antigen-antibody interaction?
- **ELISA (Enzyme-Linked Immunosorbent Assay).**
20. Animals that have had their DNA manipulated to express a foreign gene are called?
- **Transgenic animals.**
21. The first transgenic cow, capable of producing human protein-enriched milk, was named?
- **Rosie.**
22. Transgenic mice are often used for what primary purpose?
- **To test the safety of vaccines.**
23. What is the protein alpha-1-antitrypsin used to treat?
- **Emphysema.**
24. The unauthorized use of bio-resources by organizations without proper authorization is called?
- **Biopiracy.**
25. Which Indian organization makes decisions regarding the validity of GM research?
- **GEAC (Genetic Engineering Approval Committee).**
26. The ability of a single plant cell to regenerate into a whole plant is called?
- **Totipotency.**
27. The production of a large number of plants in a short time through tissue culture is called?
- **Micropropagation.**
28. Micropropagation involves what type of reproduction?
- **Asexual reproduction.**
29. Artificial seeds are produced from what?
- **Somatic embryos.**
30. The chemical used to induce the fusion of protoplasts in culture is?
- **PEG (Polyethylene glycol).**
31. The large-scale culturing of fish and other aquatic animals is called?
- **Pisciculture.**
32. What food source is particularly rich in protein: fish flour or wheat?
- **Fish flour.**
33. A dramatic increase in food production, especially wheat and rice, is known as the?
- **Green Revolution.**
34. 'Sonalika' and 'Kalyan Sona' are high-yielding varieties of what crop?
- **Wheat.**
35. 'Taichung Native-1' is a variety of what crop?
- **Rice.**
36. Developing yellow mosaic virus-resistant mung beans was achieved through what technique?
- **Mutation breeding.**
37. 'Hisardale' is a new breed of sheep developed through what breeding technique?
- **Cross-breeding.**
38. 'Jaffrabandi', 'Murrah', and 'Mehsana' are all breeds of what animal?
- **Buffalo.**
39. The first animal to be successfully cloned was?
- **A sheep named Dolly.**
40. How many varieties of Basmati rice are grown in India?
- **27.**
41. What are plants called that are genetically identical to the original plant from which they were grown?
- **Somoclones.**
42. What is the main purpose of gene therapy?
- **To correct a defective gene in a person's cells.**
43. What is the full form of MOET in animal breeding?
- **Multiple Ovulation Embryo Transfer technology.**
44. The transgenic protein 'hirudin' (an anticoagulant) was produced in the seeds of which plant?
- **Brassica napus.**
45. What does GMO stand for?
- **Genetically Modified Organism.**
46. What is a "transgene"?
- **A gene that has been transferred from one organism to another.**
47. What is a man-made allopolyploid cereal crop created by crossing wheat and rye?
- **Triticale.**
48. A plant containing a gene that provides resistance to herbicides is called what?
- **A herbicide-resistant plant.**
49. The hormone insulin is naturally produced by which organ?
- **The pancreas.**

IMPORTANT QUESTIONS AND ANSWERS

1. Mention the adaptations of wind-pollinated flowers.

Wind-pollinated (anemophilous) flowers show several adaptations to ensure successful pollination. 1. The flowers are typically small, inconspicuous, and lack bright colors or nectar. 2. They produce huge quantities of pollen grains that are light and non-sticky. 3. The stamens are well-exposed to easily disperse pollen into wind currents, and the stigmas are large and feathery to efficiently trap airborne pollen.

2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone refers to one or more organisms that are morphologically and genetically identical to their single parent, produced through asexual reproduction. An advantage is the preservation of desirable traits, as genetic makeup is unchanged. A disadvantage is the lack of genetic variation, which makes the entire population vulnerable to the same diseases or environmental stresses.

3. What are the names of the component cells of the embryo sac?

A mature angiosperm embryo sac typically contains seven cells. These are: one **egg cell**, two **synergids** (which together form the egg apparatus), three **antipodal cells** at the opposite end, and one large **central cell** which contains two polar nuclei.

4. What do you understand by emasculation? Why is it done?

Emasculation is the surgical removal of anthers from a bisexual flower before they mature and release pollen. This technique is a crucial step in artificial hybridization. It is performed to prevent self-pollination and to ensure that the flower can be cross-pollinated exclusively with pollen from a desired male parent, allowing breeders to create new plant varieties with specific traits.

5. Tell about false fruit with an example.

A false fruit, or pseudocarp, is a fruit that develops from parts of the flower other than the ovary. While a true fruit develops only from the ovary, a false fruit includes tissues like the thalamus or receptacle as a major fleshy part. A well-known example is the apple, where the edible portion is the swollen thalamus, not the ovary.

6. Give the definition of monocarpic fruits with an example.

Monocarpic plants are those that flower, produce fruits, and then die. The term 'monocarpic fruits' refers to the fruits produced by these plants during their single, terminal reproductive event. This strategy allows the plant to invest all its resources into producing offspring once. Examples include the fruits of bamboo and agave.

7. Explain false fruit with an example.

A false fruit is one in which the fleshy, edible part develops from floral tissues other than the ovary. In contrast, a true fruit develops entirely from the ovary. In a false fruit, the thalamus or receptacle often grows to form the main part of the fruit. A good example is the strawberry, where the red fleshy part is the receptacle, and the true fruits are the small achenes on its surface.

8. Write a short note on asexual reproduction in organisms.

Asexual reproduction is a mode of reproduction where offspring arise from a single parent, without the fusion of gametes. The offspring are genetically identical to the parent and are called clones. This method is common in unicellular organisms, simple animals, and many plants. Key methods include binary fission (e.g., Amoeba), budding (e.g., Yeast, Hydra), and vegetative propagation in plants.

9. Explain asexual reproduction in an organism with the help of example.

Asexual reproduction is a process where a single parent gives rise to offspring that are genetically identical to it. For example, the freshwater organism *Hydra* reproduces asexually through budding. A small bud develops as an outgrowth on the parent's body. This bud grows, develops tentacles and a mouth, and eventually detaches to live as an independent individual.

10. Define the following: (i) Protozoan endoparasite (ii) Ovule

(i) **Protozoan endoparasite:** This is a single-celled eukaryotic parasite that lives inside the body of its host, deriving nourishment and causing harm. An example is *Plasmodium*, the protozoan that causes malaria in humans. (ii) **Ovule:** This is the structure within a flowering plant's ovary that contains the female gamete (egg). After fertilization, the ovule matures into a seed.

11. Define and give one example of each of the following. (i) False fruit (ii) True fruit (iii) Parthenocarpic fruits (iv) Polyembryony

(i) **False Fruit:** A fruit formed from parts other than the ovary. Example: Apple. (ii) **True Fruit:** A fruit formed solely from the ovary. Example: Mango. (iii) **Parthenocarpic Fruit:** A fruit that develops without fertilization, making it seedless. Example: Banana. (iv) **Polyembryony:** The occurrence of more than one embryo in a seed. Example: Citrus fruits.

12. What is the importance of embryosac in angiospermic plants?

The embryo sac is fundamentally important for sexual reproduction in angiosperms. It contains the egg cell, which upon fertilization forms the zygote (the future embryo). It also contains the central cell with polar nuclei, which after fertilization forms the primary endosperm nucleus. This nucleus develops into the endosperm, a nutritive tissue that provides food for the embryo's development and germination.

13. Show the well labelled diagram of an angiospermic 8-nucleate embryo-sac.

A diagram would depict an oval structure. At the micropylar end, label the **egg apparatus**, consisting of one central **egg cell** and two **synergids**. At the opposite chalazal end, label the three **antipodal cells**. In the center, label the large **central cell** containing the two **polar nuclei**.

14. Define cross-pollination with the help of suitable example.

Cross-pollination, or xenogamy, is the transfer of pollen from the anther of a flower on one plant to the stigma of a flower on a different plant of the same species. It requires external agents like wind, water, or animals. For example, maize plants rely on wind for cross-pollination, releasing large amounts of pollen to be carried to the tassels of other plants.

15. What do you understand by parthenogenesis ? Explain with example.

Parthenogenesis is a natural form of asexual reproduction where an embryo develops from an unfertilized ovum. This process does not require fertilization by a male gamete. A common example is seen in honey bees, where the queen bee lays unfertilized eggs that develop into haploid male bees, known as drones.

16. Describe the structure of microsporangium.

A young microsporangium (pollen sac) has a circular structure with four distinct wall layers. From outermost to innermost, they are the **epidermis**, the **endothecium**, the **middle layers**, and the **tapetum**. The tapetum is the nutritive layer for developing pollen grains. At the center is the **sporogenous tissue**, composed of microspore mother cells which undergo meiosis to form microspores (pollen grains).

17. Explain double fertilization.

Double fertilization is a characteristic feature of angiosperms. After the pollen tube releases two male gametes into the embryo sac, two fusion events occur: 1. **Syngamy:** One male gamete fuses with the egg cell to form the diploid ($2n$) zygote. 2. **Triple Fusion:** The second male gamete fuses with the two polar nuclei in the central cell, forming the triploid ($3n$) primary endosperm nucleus, which develops into the endosperm.

18. What is double fertilisation? in which plant group does it occur?

Double fertilization is a complex reproductive process unique to **angiosperms** (flowering plants). It involves two key events: the fusion of one male gamete with the egg cell to form the diploid zygote, and the fusion of the second male gamete with the two polar nuclei to form the triploid endosperm.



Chapter 11: Organisms and Populations

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. The study of interactions among organisms and their environment is called?
- **Ecology.**
2. Who is known as the Father of Ecology in India?
- **Ramdeo Misra.**
3. As one moves from the equator towards the poles, what happens to the temperature?
- **It decreases.**
4. As one moves up in altitude, what happens to the temperature?
- **It decreases.**
5. What is the ability of an organism to adjust to its environment called?
- **Adaptation.**
6. Plants that are adapted to live in dry, desert conditions are called?
- **Xerophytes.**
7. Opuntia (prickly pear cactus) and Acacia are examples of what type of plant?
- **Xerophytes.**
8. A key adaptation of xerophytes to reduce water loss is?
- **Sunken stomata and thick cuticles.**
9. Plants that are adapted to live in water are called?
- **Hydrophytes.**
10. Trapa (water chestnut) and Hydrilla are examples of what type of plant?
- **Hydrophytes.**
11. A key characteristic of hydrophytes is the reduction of what tissues?
- **Vascular and mechanical tissues.**
12. Plants that grow on rocks are called?
- **Lithophytes.**
13. Plants that grow in mangrove areas are called?
- **Halophytes (e.g., Rhizophora).**
14. A group of individuals of the same species living in a given area is a?
- **Population.**
15. The number of births in a population during a given period is called?
- **Natality.**
16. The number of deaths in a population during a given period is called?
- **Mortality.**
17. The ratio of the birth rate to the death rate in a population is called the?
- **Vital Index.**
18. An age pyramid with a broad base, showing a high number of pre-reproductive individuals, indicates what?
- **An expanding population.**
19. At which level does natural selection operate to evolve desired traits?
- **The population level.**
20. An interaction between two species where both are benefited is called?
- **Mutualism.**
21. The relationship between fungi and algae in a lichen is an example of what?
- **Mutualism.**
22. An interaction where one species benefits and the other is unaffected is called?
- **Commensalism.**
23. The interaction between a clownfish and a sea anemone is an example of what?
- **Commensalism.**
24. An interaction where one species harms another to obtain nutrients is called?
- **Parasitism.**
25. An obligate root parasite that produces the world's largest flower is?
- **Rafflesia.**
26. An interaction where one species kills and eats another is called?
- **Predation.**
27. An interaction where both competing species are harmed is called?
- **Competition.**
28. What principle states that two closely related species competing for the same resources cannot coexist indefinitely?
- **Gause's Competitive Exclusion Principle.**
29. The process by which species avoid competition by choosing different resources is called?
- **Resource partitioning.**
30. Which organism is a well-known indicator of SO₂ (sulfur dioxide) pollution?
- **Lichens.**
31. Which of these plants are insectivorous: Drosera, Nepenthes, or Hydrilla?
- **Drosera and Nepenthes.**
32. What is the ability of soil to hold water called?
- **Water holding capacity.**
33. Which plant produces poisonous cardiac glycosides as a defense mechanism?
- **Calotropis.**
34. The internal buds produced by sponges for asexual reproduction are called?
- **Gemmules.**
35. Pacific salmon fish and bamboo are known for what reproductive strategy?
- **They reproduce only once in their lifetime.**
36. In which plant groups is water necessary for fertilization?
- **Algae, Bryophytes, and Pteridophytes.**
37. The plant tissue responsible for water transport is called?
- **Xylem.**
38. Mycorrhiza is a symbiotic association between fungi and plant roots; what is an example of an endomycorrhizal fungus?
- **Glomus.**
39. What is the movement of individuals into a population called?
- **Immigration.**
40. What is the movement of individuals out of a population called?
- **Emigration.**
41. What shape describes the population growth curve when resources are unlimited?
- **J-shaped (Exponential growth).**
42. What shape describes the population growth curve when resources are limited?
- **S-shaped (Sigmoid or Logistic growth).**
43. What does the term 'K' represent in the logistic growth model?
- **Carrying capacity.**
44. Organisms that can tolerate a wide range of temperatures are called?
- **Eurythermal.**
45. Organisms that can tolerate a narrow range of temperatures are called?
- **Stenothermal.**
46. What is an ectoparasite?
- **A parasite that lives on the outer surface of its host (e.g., lice).**
47. What is an endoparasite?
- **A parasite that lives inside the body of its host (e.g., tapeworm).**
48. The interaction where one species is harmed and the other is unaffected is called?
- **Amensalism.**

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Chapter 12: Ecosystem

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. Who first used the term 'Ecosystem'? **- A.G. Tansley.**
2. What are the two main components of an ecosystem? **- Biotic (living) and Abiotic (non-living).**
3. Organisms that produce their own food are called? **- Producers (or autotrophs).**
4. Green plants convert what form of energy into chemical energy? **- Light energy.**
5. Organisms that feed on other organisms are called? **- Consumers (or heterotrophs).**
6. Bacteria and fungi that feed on dead organic matter are called? **- Decomposers (or saprotrophs).**
7. A sequence of organisms eating one another is a? **- Food chain.**
8. Which is a correct food chain: "Goat, Cow, Grass" or "Grass, Goat, Lion"? **- Grass, Goat, and Lion.**
9. A network of interconnected food chains is a? **- Food web.**
10. Each step or level in a food chain is a? **- Trophic level.**
11. Green plants belong to which trophic level? **- The first trophic level (T1).**
12. The rate of biomass production by producers is? **- Primary productivity.**
13. The total rate of photosynthesis is called? **- Gross Primary Productivity (GPP).**
14. The rate of biomass formation by consumers is? **- Secondary productivity.**
15. How does energy flow through an ecosystem? **- It is unidirectional.**
16. What percentage of energy is transferred between trophic levels? **- 10 percent.**
17. A graphical representation of trophic structure is an? **- Ecological pyramid.**
18. Which ecological pyramid is always upright? **- The pyramid of energy.**
19. The gradual change in species composition of an area is? **- Ecological succession.**
20. The first species to colonize a bare area are? **- Pioneer species.**
21. In a dry succession (xerosere), what are the pioneer species? **- Lichens.**
22. In a wet succession (hydrosere), what are the pioneer species? **- Phytoplankton.**
23. The final, stable community in succession is the? **- Climax community.**
24. The nature of a climax community is determined by what? **- The climate.**
25. The process of breaking down dead organic matter is called? **- Decomposition.**
26. Which is NOT a process of decomposition: Leaching or Anabolism? **- Anabolism.**
27. A food chain starting with dead organic matter is a? **- Detritus food chain.**
28. The process of nutrients washing down into the soil is? **- Leaching.**
29. The cycling of nutrients like carbon and phosphorus is called? **- Nutrient cycling.**
30. The natural aging of a lake due to nutrient enrichment is? **- Eutrophication.**
31. The main cause of acid rain? **- Air pollution from NO₂ and SO₂.**
32. Which organism is an indicator of SO₂ pollution? **- Lichens.**
33. A generally safe sound intensity level for humans is? **- 20-30 decibels.**
34. According to WHO, what is a safe noise pollution standard? **- Around 20-30 decibels.**
35. Where do phytoplankton grow most abundantly in a lake? **- In the limnetic zone.**
36. What is the term for the total living matter at a trophic level? **- Standing crop.**
37. What are animals that eat only plants called? **- Herbivores.**
38. What are animals that eat other animals called? **- Carnivores.**
39. What is PAR? **- Photosynthetically Active Radiation.**
40. How much PAR do plants capture for photosynthesis? **- About 2-10%.**
41. The breakdown of detritus into smaller particles is called? **- Fragmentation.**
42. The process of forming a dark, amorphous substance from detritus is? **- Humification.**
43. The process where microbes degrade humus to release inorganic nutrients is? **- Mineralization.**
44. Which major nutrient cycle is considered a gaseous cycle? **- The carbon cycle.**
45. Which major nutrient cycle is considered a sedimentary cycle? **- The phosphorus cycle.**
46. Which zone in a lake is the shallow, well-lit water close to the shore? **- The littoral zone.**
47. What are the primary consumers in most aquatic ecosystems? **- Zooplankton.**
48. A parasitic plant that feeds on other plants is considered what type of consumer? **- A primary consumer.**
49. What is a Rhizocarpon an example of? **- A crustose lichen.**
50. What is a major source of atmospheric carbon dioxide? **- Combustion of fossil fuels.**

IMPORTANT QUESTIONS AND ANSWERS

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2. Define a clone. Write about one advantage and one disadvantage of a clone.

A clone refers to one or more organisms that are morphologically and genetically identical to their single parent, produced through asexual reproduction. An advantage is the preservation of desirable traits, as genetic makeup is unchanged. A disadvantage is the lack of genetic variation, which makes the entire population vulnerable to the same diseases or environmental stresses.

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A mature angiosperm embryo sac typically contains seven cells. These are: one **egg cell**, two **synergids** (which together form the egg apparatus), three **antipodal cells** at the opposite end, and one large **central cell** which contains two polar nuclei.

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5. Tell about false fruit with an example.

A false fruit, or pseudocarp, is a fruit that develops from parts of the flower other than the ovary. While a true fruit develops only from the ovary, a false fruit includes tissues like the thalamus or receptacle as a major fleshy part. A well-known example is the apple, where the edible portion is the swollen thalamus, not the ovary.

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Monocarpic plants are those that flower, produce fruits, and then die. The term 'monocarpic fruits' refers to the fruits produced by these plants during their single, terminal reproductive event. This strategy allows the plant to invest all its resources into producing offspring once. Examples include the fruits of bamboo and agave.

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Asexual reproduction is a mode of reproduction where offspring arise from a single parent, without the fusion of gametes. The offspring are genetically identical to the parent and are called clones. This method is common in unicellular organisms, simple animals, and many plants. Key methods include binary fission (e.g., Amoeba), budding (e.g., Yeast, Hydra), and vegetative propagation in plants.

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Chapter 13: Biodiversity and Conservation

QUICK REVISION: ONE-LINER QUESTIONS AND ANSWERS

1. The variety of life on Earth at all levels is called? **- Biodiversity.**
2. According to Robert May's estimate, what is the global species diversity? **- About 7 million.**
3. India's share of the world's species diversity is approximately what percentage? **- 8.1%.**
4. Which group of organisms has the highest number of species in nature? **- Insects.**
5. What is a region with very high levels of species richness and endemism called? **- A biodiversity hotspot.**
6. How many biodiversity hotspots have been identified in the world? **- 34.**
7. The complete disappearance of a species from Earth is called? **- Extinction.**
8. The Dodo is an example of what kind of species? **- An extinct species.**
9. Which species became extinct due to over-exploitation by humans? **- Steller's sea cow.**
10. The extinction of cichlid fish in Lake Victoria was caused by what? **- Alien species invasion (introduction of the Nile Perch).**
11. A species facing a very high risk of extinction in the wild is called? **- An endangered species.**
12. Nepenthes (pitcher plant) is an example of what kind of plant species? **- An endangered plant species.**
13. What is the book that maintains a record of rare and endangered species? **- The Red Data Book.**
14. The protection and preservation of wildlife and natural resources is called? **- Conservation.**
15. Conservation of species within their natural habitats is called? **- In-situ conservation.**
16. National Parks, Sanctuaries, and Biosphere Reserves are examples of what type of conservation? **- In-situ conservation.**
17. What is protected in a National Park? **- Both flora (plants) and fauna (animals) of the entire ecosystem.**
18. Conservation of species outside their natural habitats is called? **- Ex-situ conservation.**
19. Zoological parks and botanical gardens are examples of what type of conservation? **- Ex-situ conservation.**
20. The technique of preserving genetic material at very low temperatures is called? **- Cryopreservation.**
21. What are tracts of forest set aside and protected in the name of God or deities called? **- Sacred groves.**
22. The Gir National Park is famous for which animal? **- The Asiatic lion.**
23. The Kanha National Park is famous for which animal? **- The tiger.**
24. The Rhino Sanctuary in Kaziranga National Park is located in which state? **- Assam.**
25. Periyar Sanctuary in Kerala provides protection to which animal? **- The elephant.**
26. Ranthambore National Park is located in which state? **- Rajasthan.**
27. The increase in the average temperature of the Earth is known as? **- Global warming.**
28. What is the primary cause of global warming? **- The greenhouse effect.**
29. Which of these is NOT a greenhouse gas: Methane, Nitrogen, or CO₂? **- Nitrogen.**
30. Greenhouse gases are effective at absorbing what type of radiation? **- Infrared radiation.**
31. The thinning of the protective ozone layer in the stratosphere is known as? **- Ozone depletion.**
32. What is the main cause of ozone depletion? **- Chlorofluorocarbons (CFCs).**
33. The depletion of the ozone layer leads to an increase in what type of radiation on Earth? **- UV-B radiation.**
34. Absorption of UV-B radiation is a major cause of what condition in humans? **- Snow blindness and skin cancer.**
35. The thickness of the ozone layer is measured in which units? **- Dobson Units (DU).**
36. What is the primary cause of acid rain? **- Emissions of sulfur dioxide (SO₂) and nitrogen oxides.**
37. A mixture of smoke and fog is called? **- Smog.**
38. Photochemical smog is formed from ozone, PAN, and what other pollutant? **- Nitrogen dioxide (NO₂).**
39. At what noise level is sound generally considered to be pollution? **- Above 80-99 decibels (dB).**
40. Why is Carbon Monoxide (CO) more toxic than Carbon Dioxide (CO₂)? **- It reduces the oxygen-carrying capacity of hemoglobin.**
41. What is a common example of a non-biodegradable pollutant? **- DDT or plastics.**
42. Which invasive aquatic plant is known as the 'Terror of Bengal'? **- Water hyacinth (Eichhornia crassipes).**
43. What date is celebrated as World Environment Day? **- June 5th.**
44. What date is celebrated as International Day for Biological Diversity? **- May 22nd.**
45. The World Summit on Sustainable Development in 2002 was held in which city? **- Johannesburg.**
46. What was the toxic gas responsible for the Bhopal gas tragedy? **- Methyl isocyanate (MIC).**
47. What is India's National Aquatic Animal? **- The River Dolphin.**
48. A pollutant that can cause mutations is called a? **- Mutagenic pollutant (e.g., chlorinated hydrocarbons).**
49. The famous 'Chipko Movement' was started for what purpose? **- To protect trees from being cut down.**

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