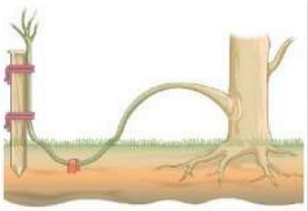
10 CHAPTER

REPRODUCTION IN PLANTS



10.1 ASEXUAL REPRODUCTION

LONG ANSWER QUESTIONS

Q.3 Write a note on binary fission.

OR

Explain the process of binary fission in bacteria and describe how it leads to the formation of two daughter bacteria. (K.B)

Ans:

BINARY FISSION

Definition:

Binary fission means **division into two**. It is the usual method of reproduction in bacteria.

Binary Fission in Bacteria:

- During binary fission, the **bacterial DNA** replicates and the daughter DNA molecules move to opposite sides.
- Then, the cell membrane **pinches in**.
- New cells wall is synthesized in the middle and so two **identical daughter cells** (bacteria) are produced.

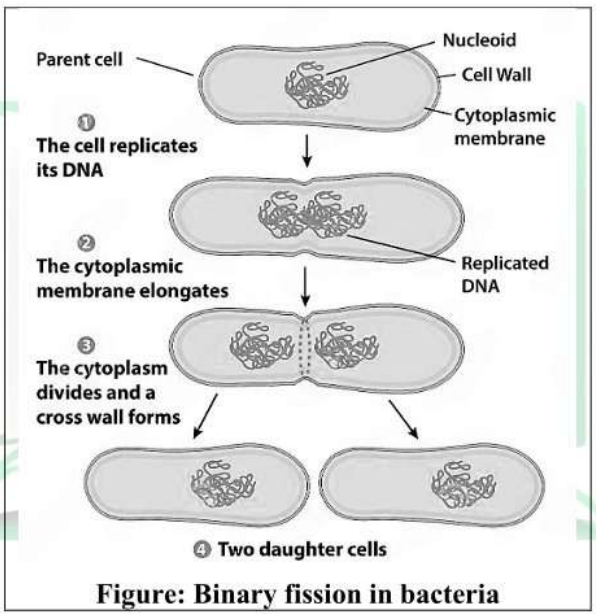


Figure: Binary fission in bacteria

Binary Fission in Protists:

- Many protists (unicellular eukaryotes e.g. ***Amoeba***, ***Euglena*** etc.) also reproduce by binary fission.
- In protists, the **nucleus** of parent organism divides into two.
- This is followed by the **division of cytoplasm**.
- So, two daughter protists are formed.

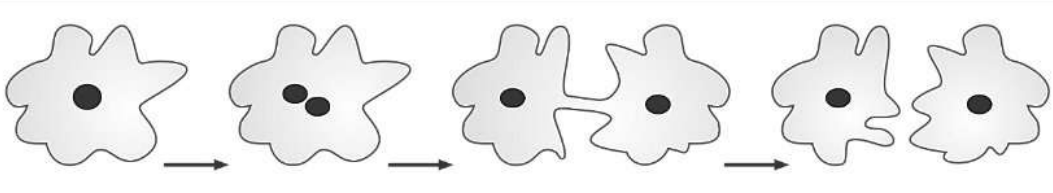


Figure: Binary fission in *Amoeba*

Q.4 Explain budding as a means of asexual reproduction. (K.B)

Ans:

BUDDING

Definition:

Budding is a method of asexual reproduction in which organism reproduces by forming a **bud**.

Budding in Yeast:

- This method is very common in **yeast** (a unicellular fungus).
- During budding, a part of the parent organism grows out from its body.
- This part is called a **bud**.
- When the bud has grown big, it may **separate** from parent body or may **remain attached**.
- Some animals e.g. ***hydra*** also reproduce asexually by budding.

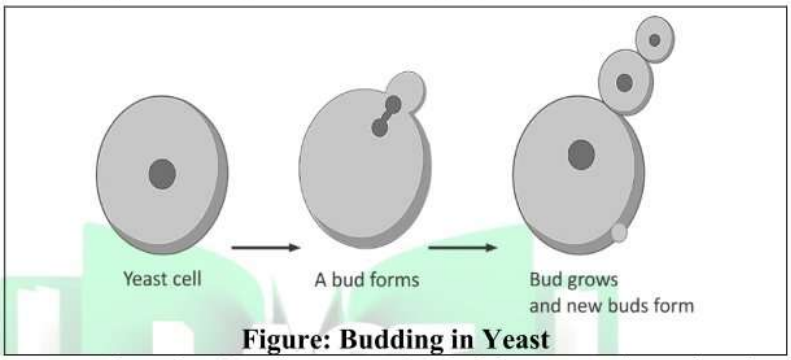


Figure: Budding in Yeast

Q.5 How organisms reproduce by forming spores? Explain spore formation in *Rhizopus* and bacteria.

Ans:

SPORE FORMATION

Spores:

Spores are **thick-walled** asexual reproductive cells.

Spore Formation in Rhizopus:

- Most fungi (e.g. ***Rhizopus***: bread mold) produce spores in special **sac-like** structures called **sporangia** (Singular: sporangium).
- When spores are mature, the sporangium **bursts** and spores are **released**.

Growth of Spores:

- Spores can **tolerate** unfavourable conditions due to their thick walls.
- When **favourable conditions** are available, the spores **germinate** to produce new fungus.

Spore Formation in Bacteria:

- Some bacteria reproduce by forming **endospores** (spores produced inside the cell).
- They form endospores in unfavourable environmental conditions.
- Even if the original cell dies, the **endospore survives**.
- When conditions improve, the endospore grows into a new bacterium.

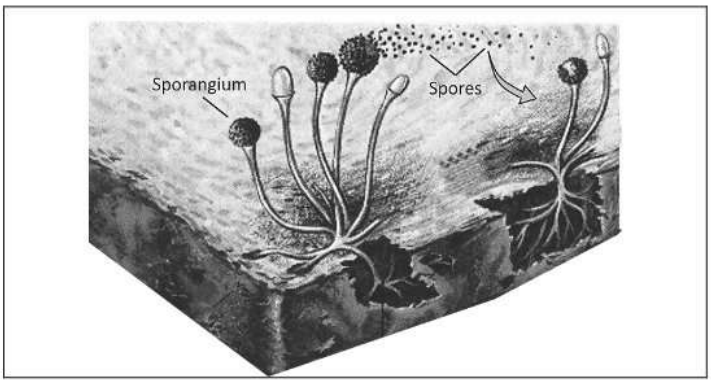


Figure: Asexual reproduction by spores (in *Rhizopus*)

Q.6 What do you mean by vegetative propagation? Differentiate among different plant structures modified for vegetative propagation. (K.B)

Ans:

VEGETATIVE PROPAGATION IN PLANTS

Definition:

It is a methods of asexual reproduction in plants. In this method, new plant is produced from the vegetative part (**root**, **stem** or **leaf**) of the parent plant.

Benefits of Vegetative Propagation:

- Vegetative propagation takes much **less time** to produce new generation as compared to the sexual method.
- Secondly, the offspring are **genetically identical** to the parent plant.

Types of Vegetative Propagation:

Vegetative propagation may be natural or artificial.

1. **Natural Vegetative Propagation**
   It is a process where plants reproduce on their own, using structures like **stems**, **roots**, or **leaves**.
2. **Artificial Vegetative Propagation**
   It means the processes in which humans use the vegetative parts of plants for their reproduction by methods like **cuttings**, **grafting**, or **layering**.

Natural Vegetative Propagation in Plants:

In the natural vegetative propagation, plants use the following modified vegetative parts for producing new plant.

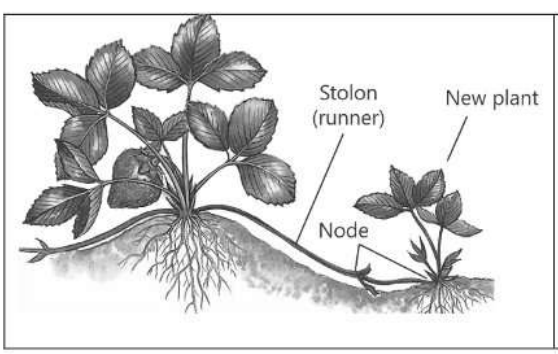
(A) Stem:

The following types of stems take part in vegetative propagation in plants:

1. **Stolon (runner)**
   - It is a **horizontal stem** that grows above the ground.
   - A stolon has **nodes** where new leaves and roots grow.
   - The **leaves** grow upwards and **roots** grow down.
   - In this way, a new plant is formed at the node.

   Example:
   Strawberry reproduces by using its stolon.
2. **Tuber**
   - It is **fleshy stem** that grows underground.
   - It has "**eyes**" which are actually its buds.
   - Eyes can grow into new plants.

   Examples:
   Potatoes reproduce by tubers.



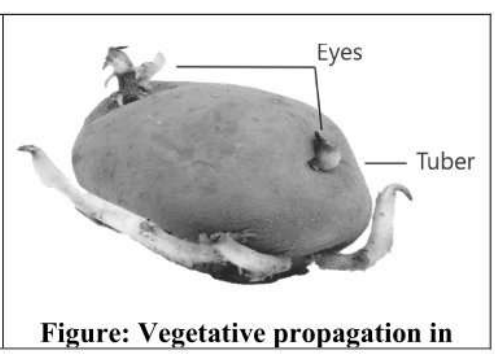


Figure: Vegetative propagation in

Figure: Vegetative propagation in strawberry (through runners)	potato (through tuber)

3. **Rhizome**
   - It is a **horizontal stem** that grows below the ground.
   - It has nodes where new leaves and roots grow.
   - In this way, a new plant grows from each node.

   Examples:
   Ferns, **ginger**, and **sugar cane** reproduce by using rhizome.
4. **Bulb**
   - It is a very **short stem** that grows underground.
   - It has bud and **fleshy leaves**.
   - Bulbs grows naturally to produce new plants.

   Examples:
   Tulips, **onions** and **lilies** reproduce by bulbs.

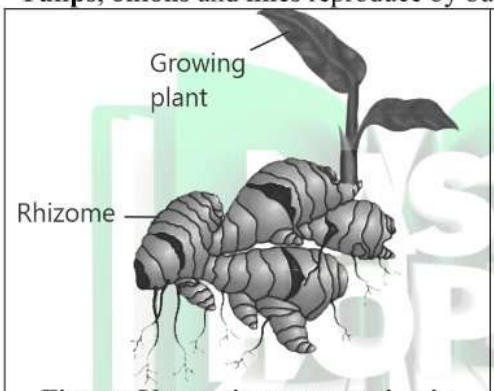


Figure: Vegetative propagation in ginger (through rhizome)

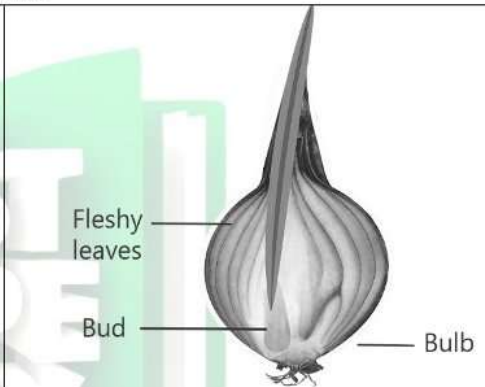


Figure: Vegetative propagation in onion (through bulb)

5. **Corm**
   - It **resembles the bulb** but does not have fleshy leaves.
   - Almost all of a corm consists of stem, with a few brown **non-functional leaves** on the outside.

   Examples:
   Dasheen and **garlic** reproduce by corms.

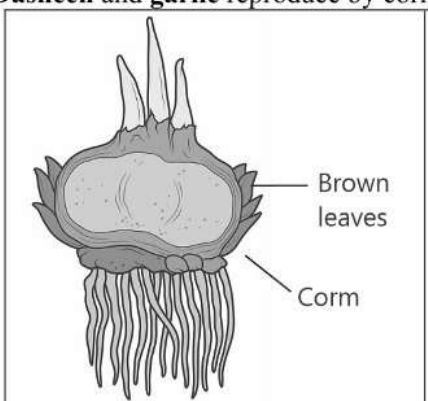


Figure: Vegetative propagation in garlic (through corm)

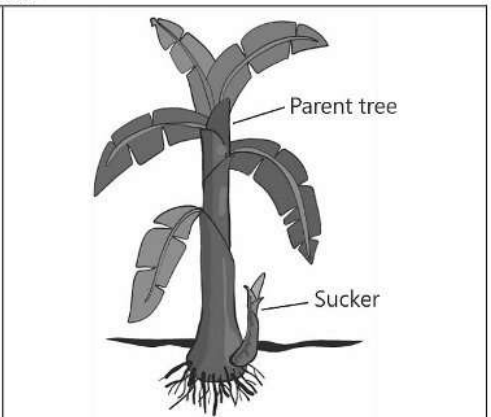


Figure: Sucker in banana

(B) Suckers:

- Suckers are new **shoots** that emerge from the base of the parent plant or from its underground roots.
- These shoots grow into new plants while still **attached to the parent**.
- When suckers develop their own **root system**, they become independent.

Examples:

Banana and **raspberry** plants.

(C) Modified Leaves:

- The leaves of some plants (e.g. ***Bryophyllum***) are modified for vegetative propagation.
- Such leaves have buds at their **margins**.
- When **leaf falls** on ground, the buds grow into new plants.

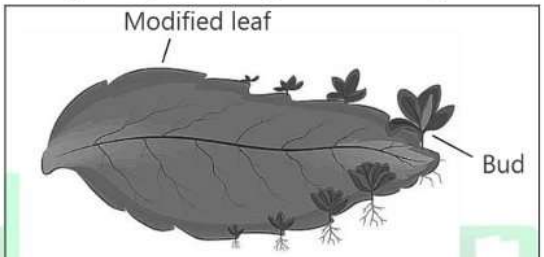


Figure: Modified leaf of *Bryophyllum*

SHORT ANSWER QUESTIONS

Q.12 Define asexual and sexual reproduction. (K.B)

Ans:

TYPES OF REPRODUCTION

Asexual Reproduction:

The reproduction that does not involve the fusion of gametes is called asexual reproduction. The offspring produced by asexual reproduction are genetically identical to the parents.

Sexual Reproduction:

The reproduction that involves the fusion of male and female gametes is called sexual reproduction. In sexual reproduction, the offspring have variations among themselves and with the parents.

Q.13 How bacteria reproduce by binary fission? (K.B)

Ans:

BINARY FISSION

Steps of Binary Fission:

a) DNA Duplication
During binary fission, the **bacterial DNA** replicates and the daughter DNA molecules move to opposite sides.

b) Invagination of Membrane
Then, the cell membrane **pinches in**.

c) Splitting of Cells
New cells wall is synthesized in the middle and so two **identical daughter cells** (bacteria) are produced.

Q.14 What is a sporangium? (K.B)

Ans:

SPORANGIUM

Definition:

In many fungi, like *Rhizopus*, when they're ready to make new ones, their body cells create strong, protective sac-like structures called sporangia (singular – sporangium).

Q.15 Define vegetative propagation. (K.B)

Ans:

VEGETATIVE PROPAGATION

Definition:

It is a form of asexual reproduction in plants where new individuals are produced from the vegetative parts (roots, stems, leaves, or buds) of the parent plant, resulting in genetically identical offsprings.

Q.16 Is spore formation seen in bacteria? Explain. (K.B)

Ans: **SPORE FORMATION IN BACTERIA**

Yes, bacteria also reproduce by spore formation.

Explanation:

- Some bacteria reproduce by forming **endospores** (spores produced inside the cell).
- They form endospores in unfavourable environmental conditions.
- Even if the original cell dies, the **endospore survives**.
- When conditions improve, the endospore grows into a new bacterium.

Q.17 Explain budding in Yeast. (K.B)

Ans: **BUDDING IN YEAST**

Definition:

Budding is a method of asexual reproduction in which organism reproduces by forming a **bud**.

Budding in Yeast:

- This method is very common in **yeast** (a unicellular fungus).
- During budding, a part of the parent organism grows out from its body.
- This part is called a **bud**.
- When the bud has grown big, it may **separate** from parent body or may **remain attached**.

Q.18 Enlist the types of natural vegetative propagation. (K.B)

Ans: **TYPES OF NATURAL VEGETATIVE PROPAGATION**

Following are the types of natural vegetative propagation:

- Bulbs
- Corm
- Rhizome
- Stem tubers
- Stolon or Runners
- Suckers
- Leaves

Q.19 How plant reproduce by bulbs formation? (K.B)

Ans: **BULBS FORMATION**

Definition:

A bulb is a very **short stem** that grows underground. It has bud and **fleshy leaves**.

Roots Formation:

Beneath the bulb's base, adventitious roots sprout.

Shoots Formation:

Shoots emerge from the upper region of the bulb. Each shoot is capable to be developed into a new plant.

Example of Plants:

Species that utilize bulb to produce their young ones are:

- Tulips
- Onions
- Lilies

Q.20 How bulbs are different from corms? (U.B)

Ans: **BULBS AND CORMS**

Bulb:

A bulb is a very **short stem** that grows underground. It has bud and **fleshy leaves**.

Corm:

It **resembles the bulb** but does not have fleshy leaves. Almost all of a corm consists of stem, with a few brown **non-functional leaves** on the outside.

Q.21 How Stolon/Runners give rise to new plants? (K.B)

Ans:

STOLON/RUNNERS

Definition:

It is a **horizontal stem** that grows above the ground.

Growth of Stolon:

- A stolon has **nodes** where new leaves and roots grow.
- The **leaves** grow upwards and **roots** grow down.
- In this way, a new plant is formed at the node.

Example:

Strawberry reproduces by using its stolon.

Q.22 What is the source of nutrients for suckers? (K.B)

Ans:

SOURCE OF NUTRIENTS

Definition:

Suckers are new **shoots** that emerge from the base of the parent plant or from its underground roots.

Growth of Suckers:

- These shoots grow into new plants while still **attached to the parent**.
- When suckers develop their own **root system**, they become independent.

Source of Nutrients:

Until maturation, suckers remain attach with parent plant and get nutrients from them.

Q.23 How leaves act as an agent of vegetative propagation? (K.B)

Ans:

VEGETATIVE PROPAGATION BY LEAVES

Explanation:

- The leaves of some plants (e.g. ***Bryophyllum***) are modified for vegetative propagation.
- Such leaves have buds at their **margins**.
- When **leaf falls** on ground, the buds grow into new plants.

Q.24 Differentiate between natural and artificial vegetative propagation. (K.B)

Ans:

DIFFERENTIATION

Natural Vegetative Propagation	Artificial Vegetative Propagation
DEFINITION	
It is a methods in which plants reproduce on their own using vegetative parts like stems, roots, or leaves.	It is a method in which humans use vegetative parts of plants for reproduction through specific techniques.
PROCESS	
Occurs naturally without human intervention.	Involves human intervention and techniques like cuttings, grafting, or layering.
PURPOSE	
Ensures natural reproduction and survival of species.	The purpose is rapid propagation, improving traits, or producing desired plants.

MULTIPLE CHOICE QUESTIONS

19. It is not a characteristic of asexual reproduction. (K.B)

(A) Gamete formation does not take place (B) Single parent is involved

(C) Variation occurs at small scale (D) Produces identical offsprings

20. Clones are produced by: (K.B)

(A) Asexual reproduction (B) Sexual reproduction
(C) External reproduction (D) Gamete formation

21. Bacteria reproduces by: (K.B)
(A) Binary fission (B) Fragmentation
(C) Parthenogenesis (D) Budding

22. A tiny outgrowth formed on yeast is: (K.B)
(A) Swelling (B) Outgrowth
(C) Spore (D) Bud

23. Yeast reproduces by: (K.B)
(A) Binary fission (B) Fragmentation
(C) Parthenogenesis (D) Budding

24. A sac-like structure containing spores, in *Rhizopus* is: (K.B)
(A) Sporangiophore (B) Sporangium
(C) Spore-sac (D) Stalk

25. Under unfavourable conditions, some bacteria can reproduce by: (K.B)
(A) Spore formation (B) Fragmentation
(C) Parthenogenesis (D) Budding

26. The spore formed inside the bacterial cell is known as: (K.B)
(A) Exospore (B) Internal spore
(C) Endospore (D) Sporophore

27. The spores of these organisms are not produced by asexual reproduction: (K.B)
(A) Seed producing plants (B) Bryophytes
(C) Pteridophytes (D) All of these

28. The bacterial species that reproduce by spore formation is/are: (K.B)
(A) Bacillus (B) Clostridium
(C) Actinomycetes (D) All of these

29. It does not reproduce by bulbs formation. (K.B)
(A) Onion (B) Garlic
(C) Lilies (D) Tulips

30. An example of stem tuber is: (K.B)
(A) Potato (B) Garlic
(C) Ginger (D) Tulips

31. Underground stem covered with fleshy leaves is a characteristic of: (K.B)
(A) Runners (B) Bulbs
(C) Rhizome (D) Corm

32. Ginger, ferns and water lilies reproduce by: (K.B)
(A) Runners (B) Bulbs
(C) Rhizome (D) Corm

33. An example of plant that reproduce by runners is: (K.B)
(A) Potato (B) *Bryophyllum*
(C) Strawberry (D) Tulips

10.2 ARTIFICIAL PROPAGATION

LONG ANSWER QUESTIONS

Q.1 Describe the ways by which humans can grow new plants by using the vegetative parts of the parent plants. (K.B)

Ans:

ARTIFICIAL VEGETATIVE PROPAGATION

Definition:

Artificial propagation includes the methods in which **humans** produce new plants by using the

vegetative parts of plants.

Importance:

Artificial propagation is used to cultivate plants with **desirable characteristics** or to **increase crop production**.

Techniques:

It includes techniques such as **cutting**, **grafting**, or **tissue culture**.

1. **Cutting**
   - In some plants, a **piece of stem** or a **piece of root** can form a new plant.
   - Such a piece of stem or root that are **cut** from a plant and used to grow new plant is called cutting.

   Importance:
   - Cuttings are widely used to propagate **houseplants**, **ornamental trees** and **shrubs**, and some **fruit crops**.
   - **Roses** and **grapevines** are grown from stem cuttings.
   - **Sweet potato** is grown from root cuttings.

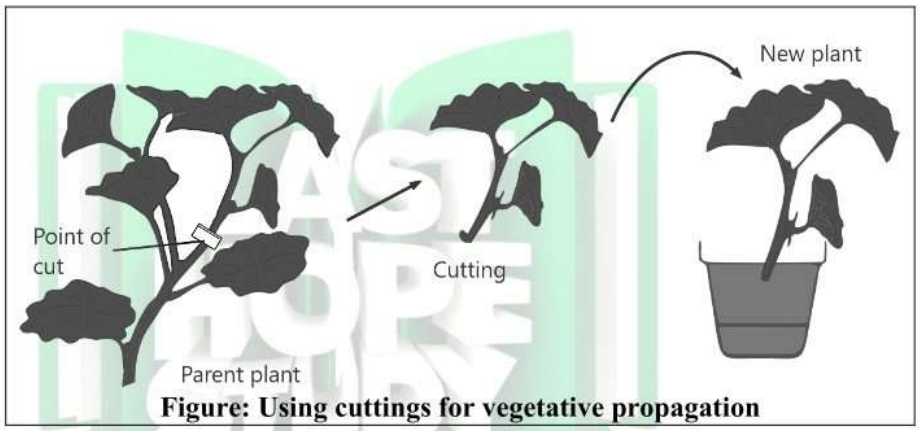


Figure: Using cuttings for vegetative propagation

2. **Grafting**

   Grafting is the **joining of two or more plant parts** of the same type to form a single plant.

   Methods of Grafting:
   - In grafting, a **bud** or **small stem** of one plant is attached to the roots or stems of a second plant.
   - Grafting enables to combine the **beneficial characteristics** of two plants.

   Importance:

   This method is used to propagate almost all **commercial fruit trees** and (e.g. almond, plum, cherries etc.), many **ornamental trees** and **shrubs**.

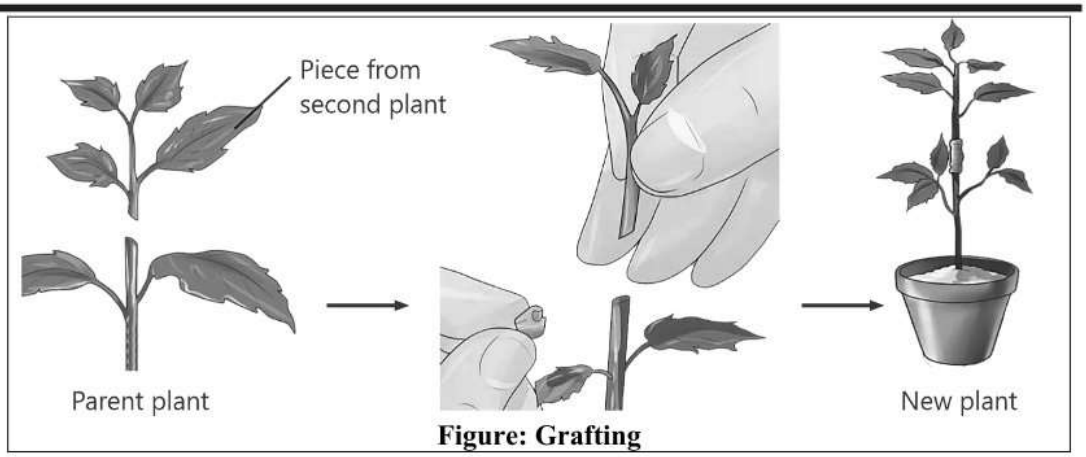


Figure: Grafting

Q.2 Write down some advantages and disadvantages of vegetative propagation. (U.B)

Ans: **VEGETATIVE PROPAGATION**

Advantages of Vegetative Propagation:

1. **Fast Growth**
   Vegetative propagation allows to produce many new plants in a **short time**.
2. **Preserving good Qualities**
   - The new plants are exactly like the parent plant, so they all have the same **good characteristics**.
   - This means **useful qualities**, like **good fruit** or **strong growth**, are passed on to the next generation.

Disadvantages of Vegetative Propagation:

1. **Lack of Variations**
   - Plants produced through vegetative propagation **do not have genetic differences**.
   - In other words, all the offspring are **identical**.
2. **Vulnerable to Diseases**
   Due to less variations, they are equally sensitive to environmental changes and **prone** to the same **diseases** or **pests**.

SHORT ANSWER QUESTIONS

Q.1 Define cutting as a method of plant propagation. (K.B)

Ans: **CUTTING**

Explanation:

- In some plants, a **piece of stem** or a **piece of root** can form a new plant.
- Such a piece of stem or root that are **cut** from a plant and used to grow new plant is called cutting.

Q.2 Which plants are propagated by cutting? (K.B)

Ans: **CUTTING**

Examples:

- Cuttings are widely used to propagate **houseplants**, **ornamental trees** and **shrubs**, and some **fruit crops**.
- **Roses** and **grapevines** are grown from stem cuttings.
- **Sweet potato** is grown from root cuttings.

Q.3 How grafting is performed? (K.B)

Ans: **GRAFTING**

Grafting is the **joining of two or more plant parts** of the same type to form a single plant.

Methods of Grafting:

- In grafting, a **bud** or **small stem** of one plant is attached to the roots or stems of a second plant.
- Grafting enables to combine the **beneficial characteristics** of two plants.

Q.4 Give some benefits of vegetative propagation. (K.B)

Ans: **BENEFITS OF VEGETATIVE PROPAGATION**

Fast Growth:

Vegetative propagation allows to produce many new plants in a **short time**.

Preserving good Qualities:

- The new plants are exactly like the parent plant, so they all have the same **good characteristics**.
- This means **useful qualities**, like **good fruit** or **strong growth**, are passed on to the next generation.

Q.5 What could be the disadvantages of vegetative propagation. (K.B)

Ans: **DISADVANTAGES OF VEGETATIVE PROPAGATION**

Lack of Variations:

- Plants produced through vegetative propagation **do not have genetic differences**.
- In other words, all the offspring are **identical**.

Vulnerable to Diseases:

Due to less variations, they are equally sensitive to environmental changes and **prone** to the same **diseases** or **pests**.

MULTIPLE CHOICE QUESTIONS

1. A method of artificial vegetative propagation is: (K.B)

(A) Leaves (B) Grafting
(C) Suckers (D) Bulbs

2. What does artificial propagation involve? (U.B)

(A) Natural reproduction using seeds
(B) Reproduction through vegetative parts by humans
(C) Producing new plants using human-aided techniques
(D) Reproduction through pollination

3. It is not a method of artificial vegetative propagation: (K.B)

(A) Stem Cutting (B) Grafting
(C) Tissue culture (D) Runners

4. Rose is mostly reproduced by: (K.B)

(A) Stem Cutting (B) Grafting
(C) Tissue culture (D) Runners

5. This method is used to achieve better varieties among plants. (K.B)

(A) Stem Cutting (B) Grafting
(C) Tissue culture (D) Runners

6. The plants that grow by stem cuttings are: (K.B)

(A) Rose, Ivy, Onion (B) Ivy, Lilies, Rose
(C) Ginger, Lilies, Grapevines (D) Rose, Ivy, *Chrysanthemum*

7. What is the main feature of grafting? (U.B)

(A) Growing plants from seeds
(B) Combining parts of two plants to create a single plant

(C) Producing plants without roots
(D) Forming seeds artificially

8. Why are plants propagated through vegetative methods genetically identical? (U.B)
(A) They inherit traits from both parents
(B) They are clones of the parent plant
(C) They undergo cross-pollination
(D) They are exposed to environmental changes

9. What is one disadvantage of vegetative propagation? (K.B)
(A) It takes more time to grow plants
(B) Plants do not inherit desirable traits
(C) Plants are genetically identical and prone to diseases
(D) Plants cannot be propagated artificially

10.3 SEXUAL REPRODUCTION IN PLANTS

LONG ANSWER QUESTIONS

Q.1 Define sporophyte and gametophyte. State their roles in the life cycle of plants. (U.B)

Ans:

SPOROPHYTE AND GAMETOPHYTE

Introduction:

- The major groups of plants have two type **generations** during sexual reproduction which come one after the other.
- These are **sporophyte generation** and **gametophyte generation**.

Alternation of Generation:

- **The sporophyte generation** produces **spores** which grow and make the new gametophyte generation.
- **The gametophyte generation** produces **gametes** which unite and make the new sporophyte generation.
- This phenomenon is called **alternation of generations**.

Sporophyte Generation:

The sporophyte generation is **diploid** (2n) and produces haploid (1n) spores by **meiosis**.

Gametophyte Generation:

- The spores develop into **haploid gametophyte** generation.
- The gametophyte produces haploid **gametes** by mitosis.
- The haploid gametes fuse to form **diploid zygote**, which develops into the next sporophyte stage.

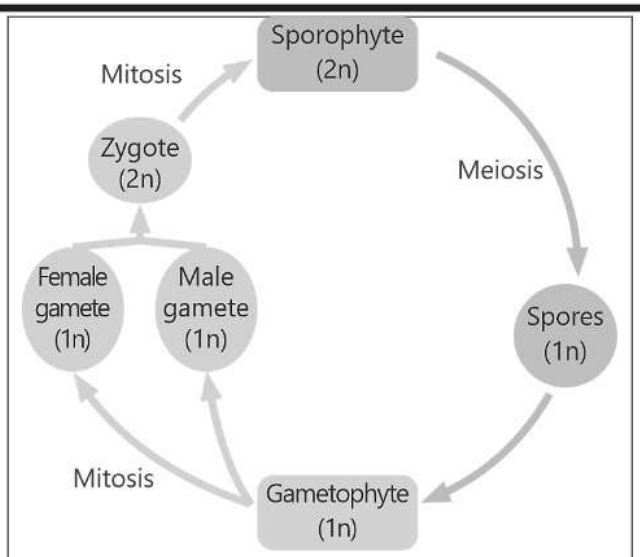


Figure: Alternation of generations in plants

Q.2 Explain the structure of a flower. (K.B)

Ans:

STRUCTURE OF FLOWER

Flower:

The flower is actually a **condensed shoot** with the nodes present very close to each other. The different parts of the flower are attached to the nodes.

Structure of Flower:

(A) Receptacle:

The receptacle is the **swollen tip** of a **flower stalk** where all the **floral** parts are attached.

Function of Receptacle

It serves as the **base** that supports the flower's structure.

(B) Floral Parts:

Floral parts are in the form of the following four **concentric whorls**, or **rings**:

1. **Calyx**
   - It is the **outermost whorl**.
   - It is made of green **leaf-like sepals**.
   - Sepals **protect** the inner parts of a developing flower before it opens.
2. **Corolla**
   - It is the second whorl and made of **petals**.
   - Most flowers have **coloured petals**.
3. **Androecium**
   - It is the third whorl and is made of **male reproductive structures** called **stamens**.
   - Each stamen consists of an **anther** and a **filament**.

Anther:

Anther contains **pollen sacs** (microsporangia), which produce **microspores**.

Filament:

The **stalk-like filament** supports the anther.

4. **Gynoecium**
   - It is the innermost whorl made of the **female reproductive structures** called **carpels**.
   - In some flowers, one or more carpels are fused to form a structure called **pistil**.
   - A carpel consists of three parts.

i) Ovary

- The **enlarged base of carpel** is called ovary.
- It is the part where **ovules** are produced.
- Ovules produce **megaspores** during reproduction.

ii) Style
The **stalk-like** part attached to ovary is called style.

iii) Stigma
The **tip of style** is called stigma.

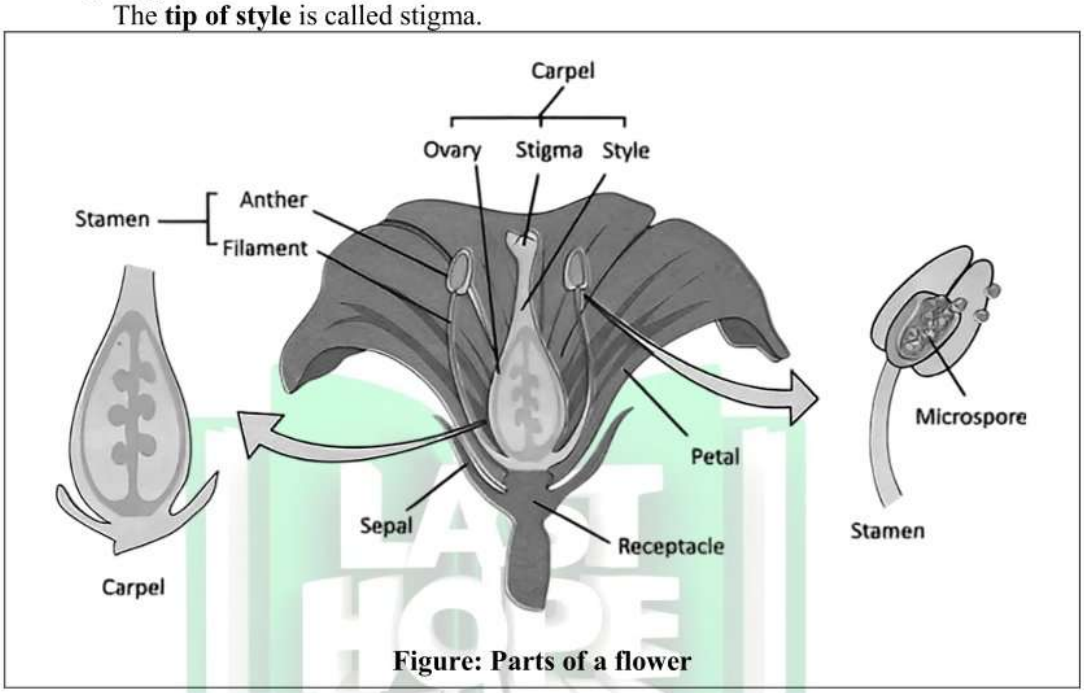


Figure: Parts of a flower

Q.3 Explain the lifecycle flowering plants, focusing on the alternation between the gametophyte and sporophyte generations. (K.B)

Ans:

LIFECYCLE OF FLOWERING PLANTS

Alternation of Generation:

- An **angiosperm** plant represents the sporophyte generation.
- When a **flower matures**, it produces spores.
- The spores germinate and make female and male gametophytes.
- The **gametophytes** are small structures consisting of few cells only.
- They make gametes which combine to form **zygote** that develops into new sporophyte.

Stages of the Life Cycle:

Following are the main stages in the life cycle of an angiosperm.

1. **Development of Female Gametophyte (Embryo Sac)**
   The **ovule** acts as megasporangium.

   Formation of Megaspores:

   - Ovule contains a diploid **megaspore mother cell** which undergoes **meiosis** and produces four **haploid megaspores**.
   - Only one megaspore remains alive.

   Division of Megaspore:

   - Inside megaspore, **eight haploid nuclei** are formed by mitosis.
   - Two nuclei migrate to the center and fuse to form a **fusion nucleus**.
   - One nucleus out of the remaining six forms the **female gamete** i.e., egg cell.

Female Gametophyte / Embryo Sac:

The resulting structure, which contains **seven cells** (one egg cell, one fusion nucleus, and five non-functional cells), is the female gametophyte or **embryo sac**.

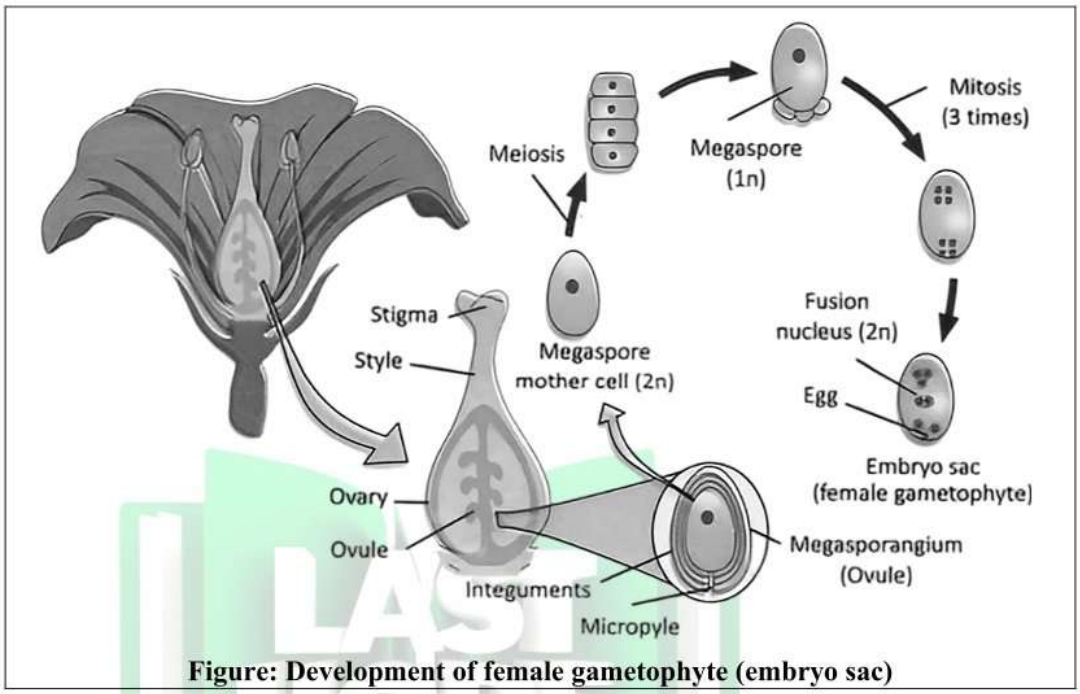


Figure: Development of female gametophyte (embryo sac)

2. **Development of Male Gametophyte (Pollen Grain)**

The **pollen sacs** present in anther act as microsporangia.

Formation of Microspores:

- Each pollen sac contains many diploid **microspore mother cells**.
- Each microspore mother cell undergoes **meiosis** and produces four **haploid microspores**.

Division of Microspore:

- A microspore undergoes **mitosis**.
- The resulting **two-celled structure** is a **pollen grain**, which is the male gametophyte.

Structure of Pollen Grain:

- One cell in pollen grain is the **tube cell**, which will form the **pollen tube**.
- The other cell is the **generative cell**, which will form **two sperms**.

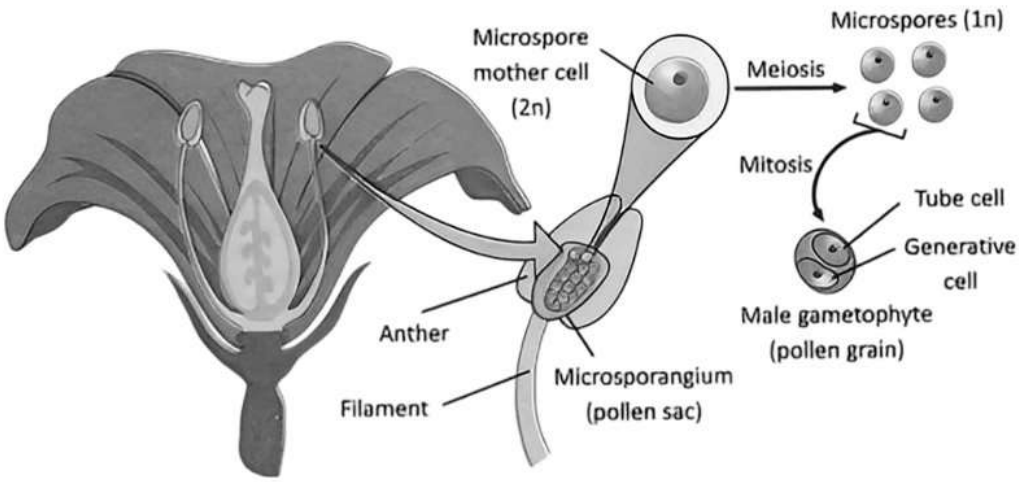


Figure: Development of male gametophyte (pollen grain)

3. **Pollination**
   - The male gametophyte (pollen grain) contains sperms while the female gametophyte (**embryo sac**) contains **egg**.
   - The pollen grains are transferred from the **anther** to the **stigma** so that the sperms can fertilize the egg.
   - It is called **pollination** i.e., the transfer of pollen grains from an anther to a stigma.
4. **Fertilization**

   Pollen Tube:
   - When pollen grain reaches stigma, its tube cell forms a **pollen tube**.
   - This tube grows through the **stigma** and **style** towards the **ovary**.
   - The pollen tube reaches the ovule and enters in it through the **micropyle**.
   - The generative cell of pollen grain forms two sperms, which enter the embryo sac to reach the egg.

   Fertilization:
   - One sperm fuses with the egg, forming a **diploid zygote**. The zygote eventually develops into an **embryo**.
   - The second sperm fuses with the **fusion nucleus**, producing a **triploid (3n) nucleus**. This nucleus then develops into tissue called **endosperm**.
   - The endosperm provides **nourishment** for the embryo.

   Double Fertilization:
   - This process of the fusion of two sperms (one with the egg and the other with the fusion nucleus) is called **double fertilization**.
   - It is a unique characteristic of angiosperms.
5. **Seed and Fruit Formation**
   - After fertilization, the **zygote** develops into **embryo** and the **triploid nucleus** develops into **endosperm tissue**.
   - After these developments, the **ovule** is said to be matured and is now called **seed**.
   - The **ovary** changes into **fruit**.
6. **Development of Sporophytes**
   - When seeds mature, they are **dispersed**.

- If seeds get suitable conditions, their **embryos** develop into new plants (the sporophytes of the next generation).

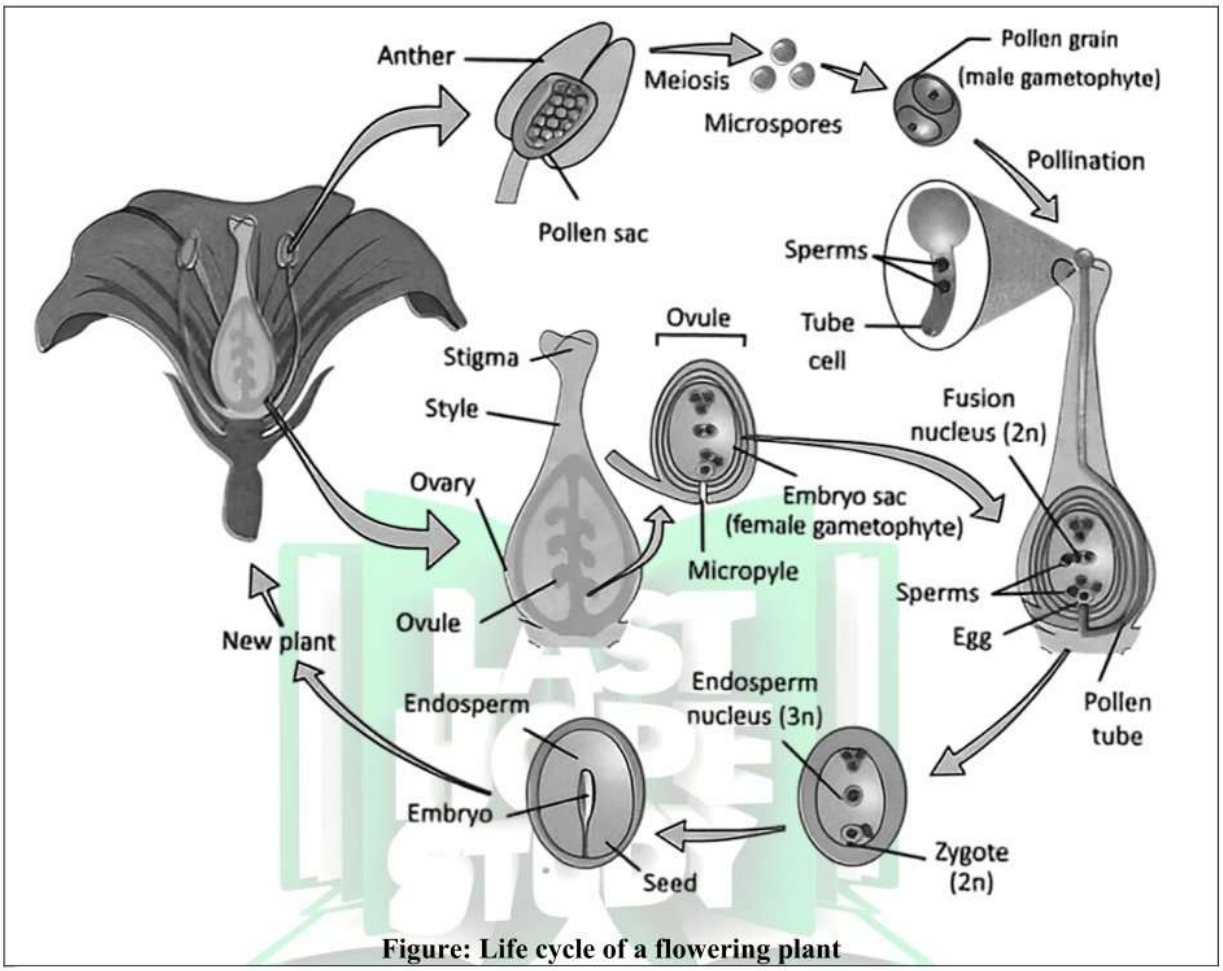


Figure: Life cycle of a flowering plant

SHORT ANSWER QUESTIONS

Q.1 What is alternation of generations? (K.B)

Ans: **ALTERNATION OF GENERATIONS**

Generations during Sexual Reproduction:

- The major groups of plants have two type **generations** during sexual reproduction which come one after the other.
- These are **sporophyte generation** and **gametophyte generation**.

Alternation of Generation:

- **The sporophyte generation** produces **spores** which grow and make the new gametophyte generation.
- **The gametophyte generation** produces **gametes** which unite and make the new sporophyte generation.
- This phenomenon is called **alternation of generations**.

Q.2 Enlist the names of whorls of a flower. (K.B)

Ans: **WHORLS OF A FLOWER**

Floral parts are in the form of the following four **concentric whorls**, or **rings**:

1. Calyx

2. Corolla
3. Androecium
4. Gynoecium

Q.3 Differentiate between androecium and gynoecium. **(K.B)**

Ans:

DIFFERENTIATION

Androecium	Gynoecium
DEFINITION	
Third whorl, consists of male reproductive structures (stamens).	Innermost whorl, consists of female reproductive structures (carpels).
MAIN COMPONENTS	
Stamen (Anther + Filament).	Carpel (Ovary + Style + Stigma).
FUNCTION	
Produces pollen grains (microspores) for male gametes.	Produces ovules (megaspores) for female gametes.

Q.4 Explain the formation of egg cell in female gametophyte. **(K.B)**

Ans:

EGG FORMATION

The **ovule** acts as megasporangium.

Formation of Megaspores:

- Ovule contains a diploid **megaspore mother cell** which undergoes **meiosis** and produces four **haploid megaspores**.
- Only one megaspore remains alive.

Division of Megaspore:

- Inside megaspore, **eight haploid nuclei** are formed by mitosis.
- Two nuclei migrate to the center and fuse to form a **fusion nucleus**.
- One nucleus out of the remaining six forms the **female gamete** i.e., egg cell.

Q.5 What is embryo sac? **(K.B)**

Ans:

EMBRYO SAC

Definition:

After mitosis in megaspore, the resulting structure which contains **seven cells** (one egg cell, one fusion nucleus, and five non-functional cells) is the female gametophyte or **embryo sac**.

Q.6 Explain the formation of pollen grain in male gametophyte. **(K.B)**

Ans:

POLLEN GRAIN FORMATION

The **pollen sacs** present in anther act as microsporangia.

Formation of Microspores:

- Each pollen sac contains many diploid **microspore mother cells**.
- Each microspore mother cell undergoes **meiosis** and produces four **haploid microspores**.

Division of Microspore:

- A microspore undergoes **mitosis**.
- The resulting **two-celled structure** is a **pollen grain**, which is the male gametophyte.

Q.7 Define pollination. Explain its types. **(K.B)**

Ans:

POLLINATION

Definition:

Pollination can be defined as the transfer of pollen grains from an anther to a stigma of the flower.

Types of Pollination:

i. Self-Pollination

The transfer of pollens from the anther to the stigma of the same flower or another flower on the same plant is called self-pollination.

ii. Cross-Pollination

The transfer of pollens from the anther of one plant to the stigma of a flower on a different plant of the same species, is called cross-pollination.

Q.8 What is double fertilization? (K.B)

Ans:

DOUBLE FERTILIZATION

Definition:

During fertilization in flower, one sperm fuses with the egg to form a **diploid zygote**. While the second sperm fuses with the **fusion nucleus**, producing a **triploid (3n) nucleus**. This process of the fusion of two sperms (one with the egg and the other with the fusion nucleus) is called **double fertilization**.

Q.9 How endosperm is formed in flowering plants? Write down its importance. (K.B)

Ans:

ENDOSPERM

Definition:

After fertilization of egg, the second sperm fuses with the **fusion nucleus**, producing a **triploid (3n) nucleus**. This nucleus then develops into tissue called **endosperm**.

Importance of Endosperm:

The endosperm provides **nourishment** (nutrients) for the embryo.

Q.10 How seed and fruit is formed? (K.B)

Ans:

SEED AND FRUIT FORMATION

Formation of Seed:

- After fertilization, the **zygote** develops into **embryo** and the **triploid nucleus** develops into **endosperm tissue**.
- After these developments, the **ovule** is said to be matured and is now called **seed**.

Formation of Fruit:

The **ovary** changes into **fruit**.

Q.11 Explain parthenocarpy. (K.B)

Ans:

PARTHENOCARPY

Definition:

In some plants, ovaries develop into fruits without fertilization of egg in ovule. So, there is no seed in fruit. This process is known as parthenocarpy.

Importance:

This process results in seedless fruits e.g. bananas and seedless varieties of grapes.

MULTIPLE CHOICE QUESTIONS

1. Sporophyte generation in plant life cycle is: (K.B)

(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

2. Gametophyte generation in plant life cycle is: (K.B)

(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

3. Male and female gametes fuse to form: (K.B)

(A) Ovum (B) Zygote
(C) Embryo (D) Fetus

4. The male reproductive part of flower is: (K.B)

(A) Stigma (B) Stamen
(C) Ovary (D) Carpel

5. How many floral whorls are present in a complete flower? (K.B)
(A) 2 (B) 4
(C) 6 (D) 8

6. The outermost whorl flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

7. Calyx is made of units called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

8. The second whorl of flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

9. Corolla is made up of units called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

10. The third whorl of flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

11. Fourth whorl of flower is: (K.B)
(A) Calyx (B) Corolla
(C) Androecium (D) Gynoecium

12. The units of androecium are called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

13. The innermost whorl of flower is called: (K.B)
(A) Calyx (B) Androecium
(C) Gynoecium (D) Corolla

14. The units of gynoecium are called: (K.B)
(A) Petals (B) Sepals
(C) Stamens (D) Carpels

15. Stamen consists of: (K.B)
(A) Anther (B) Filament
(C) Anther, Filament (D) Stigma

16. Carpel consists of: (K.B)
(A) Stigma (B) Style
(C) Ovary (D) Stigma, style, ovary

17. The egg cell is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

18. The sperm is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

19. Pollen grains are produced in anther of flower by_____. (K.B)
(A) Meiosis (B) Mitosis
(C) Binary fission (D) Multiple fission

20. The endosperm is: (K.B)
(A) Haploid (B) Diploid
(C) Triploid (D) Tetraploid

21. Which structure is present inside the ovary of the carpel? (K.B)
(A) Anther (B) Style
(C) Stigma (D) Ovule

22. The ovule develops into: (K.B)
(A) Seed (B) Fruit
(C) Flower (D) Sporophyte

23. The ovary develops into: (K.B)
(A) Seed coat (B) Fruit
(C) Seed (D) Stem

24. Pollination means transfer of pollen grain from anther to_____. (K.B)
(A) Style (B) Stigma
(C) Filament (D) Ovary

25. The purpose of endosperm is: (K.B)
(A) Pollination (B) Nourishment of embryo
(C) Cellular respiration (D) Fertilization

TEXTBOOK EXERCISE

MULTIPLE CHOICE QUESTIONS

32. Which of the following organisms commonly reproduce by binary fission?
(A) Yeast (B) Bacteria
(C) *Rhizopus* (D) Plants

33. What is the primary method of reproduction in yeast?
(A) Binary fission (B) Spore formation
(C) Budding (D) Fragmentation

34. Which of the following statements is true about spore formation in fungi?
(A) They produce spores during sexual reproduction
(B) They produce two kinds of spores
(C) Spores can only grow into new fungi in dry environments
(D) Spores are produced to withstand harsh conditions

35. What happens in some bacteria during harsh conditions?
(A) Creation of a bud that detaches from the cell
(B) Formation of thick-walled endospores
(C) Splitting the cell into two identical daughter cells
(D) Fusion of two bacterial cells

36. Which of the following is an example of vegetative propagation through runners?
(A) Potato (B) Strawberry
(C) Onion (D) Ginger

37. Which plant propagates through tubers?
(A) Onion (B) Potato
(C) Ginger (D) Garlic

38. The horizontal above ground stem, which produces leaves and roots at its nodes;
(A) Stolon (B) Bulb
(C) Rhizome (D) Corm

39. Which of these does NOT help a plant for vegetative propagation?
(A) Rhizome (B) Corm
(C) Runner (D) Flower

40. Which part of the flower is responsible for producing pollen?
(A) Stigma (B) Anther
(C) Ovary (D) Petal

41. Which of the following is NOT a part of carpel?

(A) Filament (B) Style
(C) Stigma (D) Ovary

42. Which structure forms the female gametophyte in flowering plants?
(A) Pollen grain (B) Ovule
(C) Anther (D) Sepal

43. The male gametophyte in flowering plants is known as:
(A) Pollen grain (B) Embryo sac
(C) Ovary (D) Carpel

44. In the life cycle of flowering plants, which structure is triploid (3n)?
(A) Egg (B) Fusion nucleus
(C) Endosperm nucleus (D) Sperm

45. Embryo sac is formed inside;
(A) Filament (B) Anther
(C) Style (D) Ovule

46. Double fertilization involves;
(A) Fertilization of the egg by two male gametes
(B) Fertilization of two eggs in the same embryo sac by two sperms
(C) Fertilization of the egg and the fusion nucleus by two sperms
(D) Fertilization of the egg and the tube cell by two sperms

SHORT ANSWER QUESTIONS

Q.1 Write a short note on budding in yeast.

Ans:

BUDDING IN YEAST

Definition:
Budding is a method of asexual reproduction in which organism reproduces by forming a **bud**.

Budding in Yeast:
- This method is very common in **yeast** (a unicellular fungus).
- During budding, a part of the parent organism grows out from its body.
- This part is called a **bud**.
- When the bud has grown big, it may **separate** from parent body or may **remain attached**.

Q.2 Write a short note on spore formation in fungi.

Ans:

SPORE FORMATION IN FUNGI

Spores:
Spores are **thick-walled** asexual reproductive cells.

Spore Formation in Rhizopus:
- Most fungi (e.g. ***Rhizopus***: bread mold) produce spores in special **sac-like** structures called **sporangia** (Singular: sporangium).
- When spores are mature, the sporangium **bursts** and spores are **released**.

Growth of Spores:
- Spores can **tolerate** unfavourable conditions due to their thick walls.
- When **favourable conditions** are available, the spores **germinate** to produce new fungus.

Q.3 What are the advantages of spore formation in fungi and bacteria?

Ans:

ADVANTAGES OF SPORE FORMATION

The advantages of spore formation in fungi and bacteria are:

Survival in Unfavourable Conditions:
Thick-walled spores and bacterial endospores withstand harsh environments.

Regrowth:
Spores germinate into new organisms when conditions improve.

Persistence:
Endospores ensure survival even if the original bacterial cell dies.

Q.4 Describe how vegetative propagation occurs through runners.

Ans:

RUNNERS

Runner(Stolon):

It is a **horizontal stem** that grows above the ground.

Propagation by Runner:

- A runner has **nodes** where new leaves and roots grow.
- The **leaves** grow upwards and **roots** grow down.
- In this way, a new plant is formed at the node.

Example:

Strawberry reproduces by using its runner.

Q.5 State how potatoes reproduce through tubers.

Ans:

RUBERS

Tuber:

It is **fleshy stem** that grows underground.

Growth of Tuber:

- It has "**eyes**" which are actually its buds.
- Eyes can grow into new plants.

Examples:

Potatoes reproduce by tubers.

Q.6 Describe the advantages and disadvantages of vegetative propagation.

Ans:

VEGETATIVE PROPAGATION

Advantages of Vegetative Propagation:

1. **Fast Growth**
   Vegetative propagation allows to produce many new plants in a **short time**.
2. **Preserving good Qualities**
   - The new plants are exactly like the parent plant, so they all have the same **good characteristics**.
   - This means **useful qualities**, like **good fruit** or **strong growth**, are passed on to the next generation.

Disadvantages of Vegetative Propagation:

1. **Lack of Variations**
   - Plants produced through vegetative propagation **do not have genetic differences**.
   - In other words, all the offspring are **identical**.
2. **Vulnerable to Diseases**
   Due to less variations, they are equally sensitive to environmental changes and **prone** to the same **diseases** or **pests**.

Q.7 Name the four whorls present in a flower and also tell the components of each whorl.

Ans:

WHORLS OF FLOWER

Whorl	Components
Calyx	Sepals
Corolla	Petals
Androecium	Stamen (Anther + Filament)
Gynoecium	Carpel (Ovary + Style + Stigma)

Q.8 Briefly describe the formation of egg cell and polar nuclei within embryo sac of a flower.

Ans:

EMBRYO SAC

Formation of Megaspores:

The ovule contains a diploid megaspore mother cell, which undergoes meiosis to produce four haploid megaspores, of which only one survives.

Formation of Egg and Polar Nuclei:

- This megaspore undergoes mitosis, forming eight haploid nuclei.
- Two nuclei move to the center and fuse to form polar nuclei, while one of the remaining six becomes the egg cell.

Q.9 Differentiate between:

i. Asexual and Sexual reproduction

Ans:

DIFFERENTIATION

Asexual Reproduction	Sexual Reproduction
DEFINITION	
Does not involve the fusion of gametes.	Involves the fusion of male and female gametes.
OFFSPRING	
Genetically identical to the parent.	Show variations from parents and among themselves.
GENETIC VARIATION	
No genetic variation.	Genetic variation is present.
PROCESS	
Simpler and faster.	Complex and slower.

ii. Binary fission in Bacteria and *Amoeba*

Ans:

DIFFERENTIATION

Binary fission in Bacteria	Binary fission in *Amoeba*
ORGANISM TYPE	
Prokaryotic (Bacteria)	Eukaryotic (Protists like Amoeba)
DNA REPLICATION	
Bacterial DNA replicates and moves to opposite sides.	Nucleus divides into two by mitosis.
CYTOPLASMIC DIVISION	
Cell membrane pinches in, and a new cell wall forms.	Cytoplasm divides after nuclear division.
RESULTING CELLS	
Two identical bacterial cells are formed.	Two identical daughter protists are formed.

iii. Stolon and Rhizome

Ans:

DIFFERENTIATION

Stolon (Runner)	Rhizome
GROWTH DIRECTION	
Grows horizontally above the ground.	Grows horizontally below the ground.
NODE DEVELOPMENT	
Nodes produce new leaves and roots (leaves grow upwards, and roots grow downwards).	Nodes produce new leaves and roots under the ground.
FUNCTION	
Forms new plants above ground at nodes.	Forms new plants underground at nodes.
EXAMPLES	
Strawberry	Ferns, ginger, sugarcane

iv. Bulb and corm

Ans:

DIFFERENTIATION

Bulb	Corm
STRUCTURE	
Very short underground stem with fleshy leaves.	Underground stem without fleshy leaves.

LEAVES	
Contains fleshy leaves that store food.	Has a few brown, non-functional leaves.
FUNCTION	
Grows naturally to produce new plants.	Functions mainly as a storage organ for new growth.
EXAMPLES	
Tulips, onions, lilies.	Dasheen, garlic.

v. Cutting and Grafting

Ans: **DIFFERENTIATION**

Cutting	Grafting
DEFINITION	
A piece of stem or root cut from a plant to grow a new plant.	Joining parts of two plants to form a single plant.
PROCESS	
Involves planting the cut piece to develop roots and shoots.	A bud or small stem of one plant is attached to the root or stem of another.
PURPOSE	
To propagate houseplants, ornamental trees, shrubs, and fruit crops.	To combine desirable characteristics of two plants.
EXAMPLES	
• Roses, grapevines (stem cuttings) • Sweet potato (root cuttings)	Almond, plum, cherries, and ornamental trees.

vi. Natural and Artificial Vegetative Propagation

Natural Vegetative Propagation	Artificial Vegetative Propagation
DEFINITION	
It is a methods in which plants reproduce on their own using vegetative parts like stems, roots, or leaves.	It is a method in which humans use vegetative parts of plants for reproduction through specific techniques.
PROCESS	
Occurs naturally without human intervention.	Involves human intervention and techniques like cuttings, grafting, or layering.
PURPOSE	
Ensures natural reproduction and survival of species.	The purpose is rapid propagation, improving traits, or producing desired plants.

vii. Male and Female Gametophyte

Ans: **DIFFERENTIATION**

Male Gametophyte	Female Gametophyte
LOCATION	
Pollen sac in the anther (microsporangium).	Ovule (megasporangium).
DEVELOPMENT	
The surviving megaspore undergoes mitosis, forming eight haploid nuclei.	The surviving megaspore undergoes mitosis, forming eight haploid nuclei.

STRUCTURE	
Consists of seven cells: one egg cell, one fusion nucleus, and five non-functional cells.	Consists of a tube cell (forms the pollen tube) and a generative cell (forms two sperms).

viii. Calyx and Corolla

Ans:

DIFFERENTIATION

Calyx	Corolla
POSITION	
Outermost whorl	Second whorl
COMPOSITION	
Made of green, leaf-like sepals.	Made of colored petals.
FUNCTION	
Protects the inner parts of a developing flower before it opens.	Attracts pollinators with its color and scent.

ix. Stamen and Carpel

Ans:

DIFFERENTIATION

Stamen	Carpel
POSITION	
Third whorl (male reproductive structure).	Innermost whorl (female reproductive structure).
COMPOSITION	
Made of anther and filament.	Made of ovary, style, and stigma.
FUNCTION	
Produces and releases pollen (male gametophyte).	Produces ovules (female gametophyte) and supports fertilization.
PARTS	
Anther (produces pollen) and filament (supports anther).	Ovary (produces ovules), style (connects ovary to stigma), stigma (receives pollen).

Q.10 Label the given diagram of flower.
Consult Q.No.2 of topic 10.3

EXTENSIVE ANSWER QUESTIONS

Q.1 Explain the process of binary fission in bacteria and describe how it leads to the formation of two daughter bacteria.
See Q.no.1 of topic 10.1

Q.2 What do you mean by vegetative propagation? Differentiate among different plant structures modified for vegetative propagation.
See Q.no.4 of topic 10.1

Q.3 Describe the ways by which humans can grow new plants by using the vegetative parts of the parent plants?
See Q.no.1 of topic 10.2

Q.4 Define sporophyte and gametophyte. State their roles in the life cycle of plants.
See Q.no.1 of topic 10.3

Q.5 Explain the lifecycle of flowering plants, focusing on the alternation between the gametophyte and sporophyte generations.
See Q.no.3 of topic 10.3

Q.6 Describe how the female gametophyte (embryo sac) develops within the ovule of a flower.
Consult Q.no.3 of topic 10.3

INQUISITIVE ANSWER QUESTIONS

Q.1 Why are spores considered an adaptation for survival in harsh environmental conditions?

Ans:

SPORES

Definition:
Spores are thick-walled asexual reproductive cells.

Environmental Adaptations:

1. **Resistant to Extreme Temperatures**
   Spores can tolerate unfavorable conditions like extreme temperature due to their thick walls.
2. **Desiccation Tolerance**
   Spores can withstand extreme dryness, which allows them to survive in environments with low water availability.
3. **Chemical Resistance**
   Spores are resistant to many chemicals, including disinfectants and antibiotics.
4. **Physical Protection**
   The spore coat provides physical protection against mechanical damage and radiation.
5. **Bacterial Endospore Formation**
   - Some bacteria reproduce by forming endospores (spores produced inside the cell).
   - They form endospores in unfavourable environmental conditions.
   - Even if the original cell dies, the endospore survives.
   - When conditions improve, the endospore grows into a new bacterium.

Q.2 How do asexual and sexual reproduction contribute differently to genetic diversity of plant populations?

Ans:

ASEXUAL AND SEXUAL REPRODUCTION

Asexual and sexual reproduction contribute differently to the genetic diversity of plant populations:

1. **Asexual Reproduction**
   Asexual reproduction is the type of reproduction that does not involve the fusion of gametes. Examples of asexual reproduction include runners, tubers or cuttings.
   Genetic Diversity:
   It does not increase genetic diversity because there is no mixing of genes. All offspring are exact copies of the parent.
2. **Sexual Reproduction**
   Sexual reproduction is the type of reproduction that involves the fusion of male and female gametes.
   Genetic Diversity:
   It creates genetic variation/diversity because offspring inherit a unique combination of genes from both parents.

Conclusion:
Asexual reproduction is useful for rapid, uniform growth, while sexual reproduction is key to genetic diversity and long-term survival.

Q.3 How does the pollen tube facilitates the process of fertilization in flowering plants?

Ans:

ROLE OF POLLEN TUBE

The pollen tube plays a crucial role in facilitating fertilization in flowering plants by enabling the transfer of male gametes (sperms) to the female gamete (egg) inside the ovule. It occurs in

following steps:

Formation of Pollen Tube:

When pollen grain reaches stigma, its tube cell forms a pollen tube. This tube grows through the stigma and style towards the ovary.

Entry into Ovule:

The pollen tube reaches the ovule and enters in it through the micropyle.

Fertilization:

The generative cell of pollen grain forms two sperms, which enter the embryo sac to reach the egg.

EXTRA CONCEPTUAL MCQs

1. Which of the following is incorrect about asexual reproduction?

(A) Single parent contributes genetic material (B) No gamete formation is involved
(C) Offspring are genetically identical (D) Contributes in evolution of new species

2. Which of the following is the benefit of sexual reproduction?

(A) This is rapid way of reproduction
(B) This is complex mechanism of reproduction
(C) It can occur any time in lifecycle
(D) It contributes genetic variability in successive generations

3. Which of the following modes of asexual reproduction generally occurs during unfavorable conditions?

(A) Binary fission (B) Budding
(C) Spore formation (D) Parthenogenesis

4. Which of the following is compact, thickened, vertically growing, underground stem enveloped by thick, succulent (flashy) leaves, serving as reservoir of stored nutrients?

(A) Bulb (B) Corm
(C) Rhizome (D) Stem tuber

5. In *Bryophyllum*, small plantlets that are much like tiny versions of the parent plant, are created along the:

(A) root tip (B) edges of its leaves
(C) stem surface (D) all of these

6. If sometimes, the stem cutting does not start growth, then the cut ends must be treated with which of the following special plant hormone to stimulate the growth?

(A) Somatotrophin (B) Abscisic acid
(C) Auxin (D) Ethene

7. Which of the following part of the plant that's been changed and adapted for the job of reproduction:

(A) Flower (B) Leaves
(C) Root (D) Meristematic tissue

8. Which of the following parts of the flower are called accessary whorls?

(A) Androecium and gynoecium (B) Calyx and corolla
(C) Androecium and corolla (D) Calyx and gynoecium

STUDENT LEARNING OUTCOMES (SLOs)

SHORT ANSWER QUESTIONS

Q.1 Why an organism needs reproduction?

Ans: **NEED OF REPRODUCTION**

Reproduction is a biological process through which new organisms are produced from their parents. It is fundamental to the survival of species, allowing them to pass on their genetic information to succeeding generations.

Q.2 Discuss the importance of stem tubers in agriculture.

Ans:

IMPORTANCE OF TUBERS

- Tubers are significant in agriculture because they yield more food per unit area of soil and time than most other crops.
- They can be stored for long periods without losing their nutritional value.

Q.3 Enlist some plant that are propagated by stem cutting.

Ans:

STEM CUTTING

The plants that are propagated by stem cutting as:

- Rosemary
- Mint
- Oregano
- Tomato
- Sweet potato
- Rose
- Fig
- Grapevine

Q.4 How grafting can advance the variety and way of fruit production.

Ans:

APPLICATIONS OF GRAFTING

Importance:

Through grafting, it is possible to create trees that produce different types of fruits on the same tree, often called "fruit salad trees" or "Frankenstein trees."

Example:

- One example of a "Frankenstein tree" is the **Tree of 40 Fruit**, an art project by Sam Van Aken, a professor at Syracuse University.
- He grafted different fruit plants, such as peaches, plums, apricots, nectarines, and cherries, onto a single tree, creating a stunning display of blossoms and fruits in different colours and seasons.

Q.5 What type of growing medium is used for stem cutting?

Ans:

GROWING MEDIUM

The most common growing medium used for stem cutting to grow is:

- Soil
- Water

Q.6 Enlist the steps of life cycle of flowering plant.

Ans:

LIFECYCLE OF FLOWERING PLANT

1. The development of the male gametophyte (the pollen grain) occurs in the anthers.
2. The microspore mother cells develop into pollen grains. Mature pollen grains are released from the anther.
3. Egg cell with associated structures develop from megaspore mother cells inside the ovule.
4. Meanwhile, the pollen grain lands on a stigma and forms a pollen tube that grows into the style until it reaches the ovule in the ovary.
5. The two sperm cells travel down the pollen tube.
6. The first sperm fuses with the egg to form a diploid zygote; simultaneously, another sperm fuses with the two fusion nuclei, producing a triploid endosperm nucleus.
7. The zygote matures into an embryo.
8. Once the seed germinates, it develops into a new seedling, starting a new cycle.

Q.7 Why asexual reproduction is a unique process? (U.B)

Ans:

UNIQUENESS OF ASEXUAL REPRODUCTION

Unique Features:

- Asexual reproduction doesn't rely on the formation of specialized reproductive cells called gametes.
- There is no involvement of complex process of meiosis. which shuffles genetic material to produce variation.
- Instead, asexual reproduction relies on simpler methods, such as cell division or the growth of specialized structures.
- This simplicity and genetic uniformity make asexual reproduction a reliable and efficient way for some plants to propagate and expand their population.

Q.8 Which spores are excluded from asexual reproduction and why? (U.B)

Ans:

EXCLUSION FROM ASEXUAL REPRODUCTION

Explanation:

The following spores are not supposed to be the part of asexual reproduction because during the spore formation in these plants, meiosis generally involves.

- The microspore and megaspore in seed producing plants.
- The spores of bryophytes and pteridophytes that give rise to gametophyte body.

Q.9 What are the types of buds in higher plants. (K.B)

Ans:

BUDS IN HIGHER PLANTS

Types of Buds:

In higher plants, the outgrowths are often developed which are of two types:

1. **Vegetative Buds**
   The vegetative buds give rise to new branches and leaves.
2. **Floral Buds**
   The floral buds give rise to new flowers.

Q.10 Explain the structure of embryo sac.

Ans:

EMBRYO SAC

The embryo sac, also known as the female gametophyte in flowering plants, is a seven-celled, eight-nucleate structure within the ovule. It typically consists of:

1. **One Egg Cell**
   Located near the micropyle, which becomes the zygote after fertilization.
2. **Two Synergids**
   The help guide the pollen tube to the egg.
3. **Three Antipodal Cells**
   There function is unclear and they degenerate after fertilization.
4. **One Central Cell**
   It contains two polar nuclei that fuse with a sperm cell to form the triploid endosperm, which nourishes the developing embryo.

Q.11 Justify that sexual reproduction in plants is more beneficial than asexual reproduction.

Ans:

Explanation:

Sexual reproduction in plants is more beneficial than asexual reproduction because:

- It creates genetic diversity (by meiosis) among offspring.
- The diversity helps plant populations adapt to changing environments, resist diseases and pests, and improve survival rates.
- Genetic variation also provides a greater potential for evolutionary advancements, ensuring the long-term sustainability of plant species.

MULTIPLE CHOICE QUESTIONS

23. Spores are produced in a structure known as:

(A) Capsule (B) Sporangium
(C) Bud (D) Sporangiophore

24. Zygote in flowering plants develops into:
(A) Endosperm (B) Embryo
(C) Micropyle (D) Seed coat

25. Fruit is formed by the enlargement of:
(A) Embryo in ovule (B) Ovary containing seed(s)
(C) Anther (D) Sepals

26. How many sperms are involved during fertilization in a flower?
(A) One (B) Two
(C) Three (D) Four

27. The offspring from asexual reproduction in plants are likely to:
(A) be more resistant than their parent to disease
(B) develop into a new variety
(C) grow bigger than their parent
(D) have the same flower colour as of their parent

28. After fertilization which structure develops into the seed of a flowering plant?
(A) Carpel (B) Ovum
(C) Ovule (D) Style

29. Which flower structure produce pollens?
(A) Anther (B) Petals
(C) Carpel (D) Stigma

30. Which of the following is a method of sexual reproduction in plants?
(A) Cross-pollination (B) Fertilization
(C) Budding (D) Pollination

31. What is the main purpose of flowers in plants?
(A) Photosynthesis (B) Food storage
(C) Reproduction (D) Support

32. Which part of the plant is responsible for sexual reproduction?
(A) Leaf (B) Root
(C) Stem (D) Flower

33. Which is not a method of artificial vegetative propagation?
(A) Layering (B) Budding
(C) Grafting (D) Stem cutting

34. What role does the stigma play in plant reproduction?
(A) Produce pollen (B) Absorbs sunlight
(C) Capture pollen (D) Stores nutrients

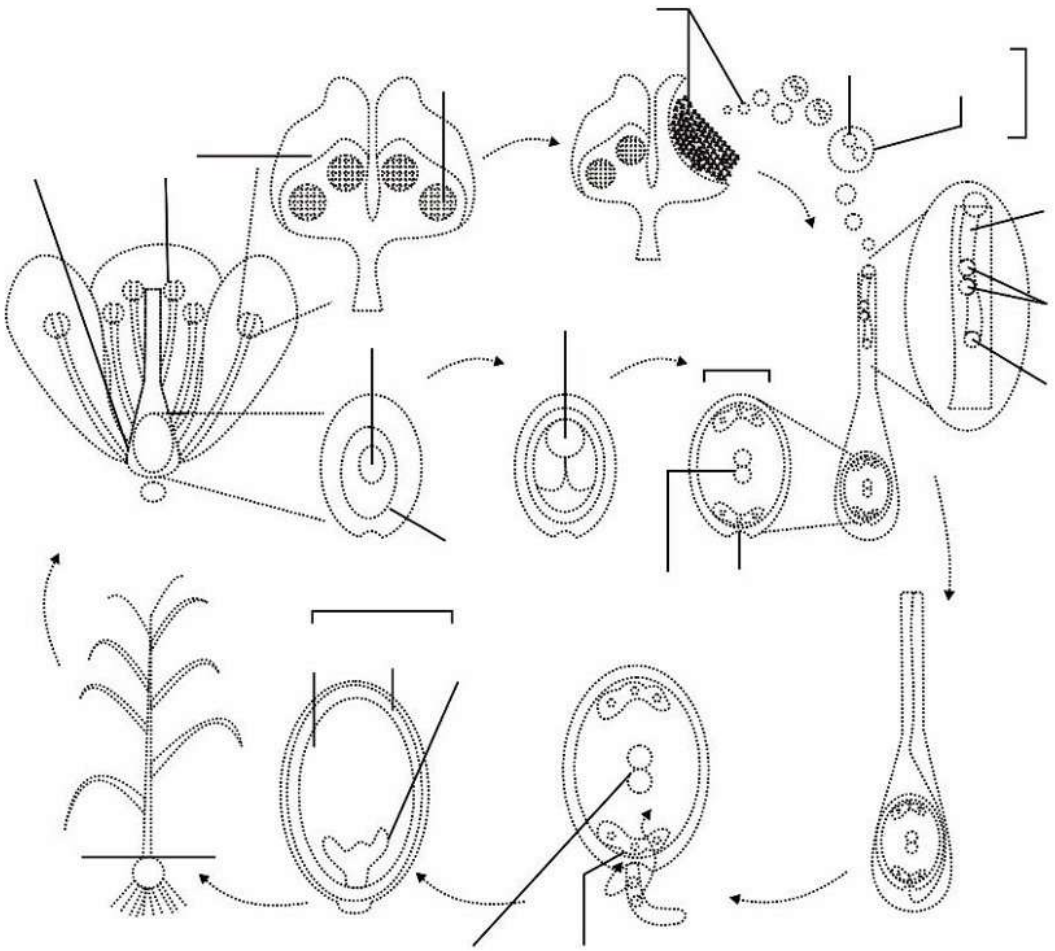
ASSIGNMENT

LET'S DRAW AND LABEL

(A) Lifecycle of a Flowering Plant

Instructions:

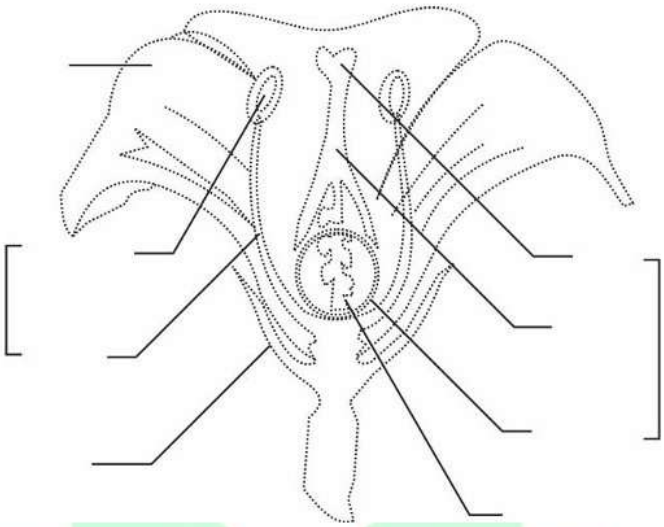
Test your concept by labelling.



(B) Structure of Flower

Instructions:

Label the components carefully



Terms to Know	
Binary Fission	Method of asexual reproduction in which parent simply divides into two identical offspring; happens in bacteria, some protists, some lower animals.
Budding	A type of asexual reproduction in which a new organism develops from a small outgrowth or "bud" on the parent.
Embryo sac	The female gametophyte of angiosperms; consists of eight haploid nuclei; formed from megaspore.
Fertilization	The union of haploid gametes to produce a diploid zygote.
Ovary	In flowers, the portion of a carpel in which the egg-containing ovules develop.
Ovum	The female gamete; the haploid, unfertilized egg.
Rhizome	Underground stems that grow horizontally; have scale leaves.
Sexual reproduction	Type of reproduction that involves the fusion of gametes.
Zygote	The diploid product of the union of haploid gametes in conception; a fertilized egg.

Answer Key

TOPIC 10.1

1	C	**2**	A	**3**	A	**4**	D	**5**	D
6	B	**7**	D	**8**	C	**9**	D	**10**	D
11	B	**12**	A	**13**	B	**14**	C	**15**	C

TOPIC 10.2

1	B	**2**	C	**3**	D	**4**	A	**5**	B
6	D	**7**	B	**8**	B	**9**	C		

TOPIC 10.3

1	B	**2**	A	**3**	B	**4**	B	**5**	B
6	A	**7**	B	**8**	D	**9**	A	**10**	B
11	D	**12**	C	**13**	C	**14**	D	**15**	C
16	D	**17**	A	**18**	A	**19**	A	**20**	C
21	D	**22**	A	**23**	B	**24**	B	**25**	B

TEXTBOOK EXERCISE MCQs

1	B	**2**	C	**3**	D	**4**	B	**5**	B
6	B	**7**	A	**8**	D	**9**	B	**10**	A
11	B	**12**	A	**13**	C	**14**	D	**15**	C

EXTRA CONCEPTUAL MCQs

1	D	**2**	D	**3**	C	**4**	A	**5**	B
		6	C	**7**	A	**8**	B		

SLOs MCQs

1	B	**2**	B	**3**	B	**4**	B	**5**	D
6	C	**7**	A	**8**	B	**9**	C	**10**	D
11	B	**12**	C						