Plants

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Concept 1: Parts of a Plant and Their Functions

Definition

A plant is a living organism that makes its own food through photosynthesis and consists of root system and shoot system.

Main Divisions

Root system

Part of plant below the ground.

Shoot system

Part of plant above the ground.

Root System

Definition

Roots anchor the plant in soil and absorb water and minerals.

Functions

Absorption of water and minerals.

Anchorage in soil.

Storage of food in some plants.

Types of Roots

Tap Root

Single main root with smaller lateral roots.

Example: carrot, radish, mustard.

Fibrous Root

Cluster of roots of similar size.

Example: wheat, rice, grass.

Adventitious Root

Roots arising from stem or leaf.

Example: banyan (prop roots), maize (support roots).

Special Root Modifications

Storage roots

Carrot stores food.

Prop roots

Banyan provides extra support.

Breathing roots

Mangrove plants grow upward roots for oxygen in marshy areas.

Shoot System

Stem

Functions

Supports plant.

Carries water and minerals from roots to leaves.

Transports food from leaves to other parts.

Transport tissues

Xylem

Carries water and minerals upward.

Phloem

Carries food to all parts.

Leaf

Definition

Main site of photosynthesis.

Parts of Leaf

Petiole

Attaches leaf to stem.

Lamina

Flat green part.

Veins

Transport materials and provide support.

Functions

Photosynthesis.

Transpiration (loss of water vapor).

Respiration.

Types of Venation

Reticulate venation

Net-like pattern.

Example: mango.

Parallel venation
Veins run parallel.
Example: grass.
Flower
Reproductive part of plant.
Main Parts
Sepals
Protect flower bud.
Petals
Attract insects.
Stamen
Male reproductive part.
Anther produces pollen.
Pistil
Female reproductive part.
Ovary contains ovules.
Fruit
Develops from ovary after fertilization.
Protects seeds.
Seed
Contains embryo.
Germination occurs under suitable conditions.
Germination Conditions
Water
Air
Suitable temperature
Types of Plants
Herbs
Soft stem.
Example: spinach.
Shrubs
Medium-sized woody stem.
Example: rose.
Trees
Tall with strong trunk.
Example: mango.
Climbers
Weak stem. Need support.
Example: pea plant.
Creepers
Spread on ground.
Example: pumpkin.
Common Examination Traps
Carrot is a stem. Incorrect. It is root.
Leaf only makes food. Incorrect. It also performs transpiration and respiration.
Flower is only for decoration. Incorrect. It is reproductive organ.
Concept Linkage
Roots absorb water.
Stem transports.
Leaf prepares food.
Flower ensures reproduction.

Concept 2: Photosynthesis

Definition
Photosynthesis is the process by which green plants prepare their own food using carbon dioxide, water and sunlight in the presence of chlorophyll.
Raw Materials
Carbon dioxide
Taken from air through stomata.
Water
Absorbed from soil by roots and transported through xylem.
Sunlight
Provides energy for the process.
Chlorophyll
Green pigment present in chloroplasts of leaf cells.

Absorbs sunlight.
Site of Photosynthesis
Leaves are the main site.
Occurs in chloroplasts.
Chemical Equation (Simplified)
Carbon dioxide + Water → Glucose + Oxygen
In presence of sunlight and chlorophyll.
Products
Glucose
Used as energy source or stored as starch.
Oxygen
Released into atmosphere.
Role of Leaf Structure
Broad lamina provides large surface area.
Veins transport water and food.
Stomata allow gas exchange.
Stomata
Small pores on leaf surface.
Allow entry of carbon dioxide.
Release oxygen and water vapor.
Guard cells regulate opening and closing.
Factors Affecting Photosynthesis
Light intensity
More light increases rate up to certain limit.
Carbon dioxide concentration
Higher concentration increases rate.
Water availability
Lack of water reduces photosynthesis.
Temperature
Moderate temperature favors process.
Importance
Primary source of food on Earth.
Maintains oxygen level in atmosphere.
Base of all food chains.
Difference Between Photosynthesis and Respiration
Photosynthesis
Occurs in green plants.
Requires sunlight.
Produces glucose and oxygen.
Respiration
Occurs in all living cells.
Does not require sunlight.
Releases energy from glucose.
Storage of Food
Glucose converted to starch.
Starch stored in leaves, roots, stems or fruits.
Examples
Potato
Stores food in stem.
Carrot
Stores food in root.
Sugarcane
Stores sugar in stem.
Common Examination Traps
Photosynthesis occurs in roots. Incorrect. It occurs mainly in leaves.
Oxygen is used in photosynthesis. Incorrect. Oxygen is produced.
Chlorophyll is present in all plant parts. Incorrect. Only in green parts.
Advanced Understanding
Light energy converts into chemical energy.
Plants are producers in ecosystem.
Starch test using iodine confirms photosynthesis.

Concept 3: Seed Structure and Germination

Definition
A seed is a mature ovule that contains an embryo and can grow into a new plant under suitable conditions.

Parts of a Seed
Seed Coat
Outer protective covering.
Protects seed from damage and drying.
Embryo
Young plant inside seed.
Has radicle and plumule.
Radicle
Develops into root.
Plumule
Develops into shoot.
Cotyledons
Seed leaves.
Store food for embryo.
Types of Seeds
Dicot Seed
Two cotyledons.
Example: bean, gram.
Monocot Seed
One cotyledon.
Example: maize, wheat.
Function of Seed
Reproduction.
Dispersal.
Protection of embryo.
Food storage.
Germination
Definition
Process by which seed grows into a new plant.
Conditions Required
Water
Softens seed coat.
Activates enzymes.
Air
Provides oxygen for respiration.
Suitable temperature
Enzymes function properly at moderate temperature.
Steps of Germination
Seed absorbs water.
Seed coat breaks.
Radicle emerges first.
Plumule grows upward.
Leaves develop and photosynthesis begins.
Types of Germination
Epigeal Germination
Cotyledons come above soil.
Example: bean.
Hypogeal Germination
Cotyledons remain below soil.
Example: maize.
Role of Cotyledons
Provide stored food until plant makes its own food.
Seed Dormancy
Some seeds do not germinate immediately even under suitable conditions.
This resting stage is dormancy.
Reasons for Dormancy
Hard seed coat.
Unfavorable environmental conditions.
Agricultural Importance
Healthy seeds ensure good crop yield.
Proper storage prevents fungal infection.
Common Examination Traps
Radicle forms shoot. Incorrect. Radicle forms root.
Seeds need sunlight for germination. Incorrect. Sunlight is not necessary for germination.
Cotyledon is root. Incorrect. It is seed leaf.

Concept Linkage
Seed contains embryo.
Germination leads to new plant.
New plant performs photosynthesis for survival.

Concept 4: Seed Dispersal

Definition
Seed dispersal is the process by which seeds are spread away from the parent plant to new places.
Importance
Reduces competition for water, light and nutrients.
Prevents overcrowding.
Increases chances of survival of species.
Methods of Seed Dispersal

1. By Wind

Characteristics
Seeds are light in weight.
Have wings or hair-like structures.
Examples
Dandelion
Cotton
Maple
Adaptations
Feathery structures.
Wing-like extensions.

1. By Water

Characteristics
Seeds are light and waterproof.
Can float on water.
Examples
Coconut
Lotus
Adaptations
Fibrous outer covering.
Air spaces for buoyancy.

1. By Animals

Characteristics
Seeds have hooks or spines.
Stick to animal fur.
Examples
Xanthium
Urena
Other method
Animals eat fruits and throw seeds away from parent plant.
Example
Mango
Guava

1. By Explosion

Characteristics
Dry fruit bursts open suddenly.
Examples
Balsam
Pea
Castor
Seeds are scattered forcefully.
Special Cases
Human activities also disperse seeds intentionally or unintentionally.
Comparison of Dispersal Methods
Wind
Light seeds with wings or hair.
Water
Floating seeds with waterproof covering.
Animals
Hooks, spines or fleshy fruits.
Explosion
Bursting pods.

Common Examination Traps
Coconut dispersed by wind. Incorrect. It is dispersed by water.
Heavy seeds dispersed by wind. Incorrect. Wind disperses light seeds.
All fruits are dispersed by animals. Incorrect. Some by wind and water.
Advanced Understanding
Seed dispersal ensures genetic diversity.
Prevents extinction of species.
Adaptations are directly linked to dispersal method.
Concept Linkage
After fertilization fruit forms.
Fruit contains seeds.
Seeds disperse and germinate to form new plant.

Concept 5: Vegetative Reproduction in Plants

Definition
Vegetative reproduction is a type of asexual reproduction in which new plants grow from vegetative parts of the parent plant such as root, stem or leaf.
Characteristics
Only one parent involved.
No seeds formed.
New plant is genetically identical to parent.
Faster method of reproduction.
Types of Vegetative Reproduction
Natural Vegetative Reproduction

1. By Stem

Underground stems
Tuber
Example: potato.
Buds present on “eyes” grow into new plant.
Rhizome
Example: ginger.
Horizontal underground stem.
Bulb
Example: onion, garlic.
Short stem with fleshy leaves.
Corm
Example: colocasia.
Runner
Example: grass, strawberry.
Horizontal stem grows above ground.

1. By Root

Example: sweet potato, dahlia.
Adventitious buds grow into new plant.

1. By Leaf

Example: bryophyllum.
Buds develop on leaf margins.
Artificial Vegetative Reproduction

1. Cutting
   Part of stem planted in soil.
   Example: rose, sugarcane.
2. Layering
   Branch bent to ground and covered with soil.
   Roots develop at covered part.
   Example: jasmine.
3. Grafting
   Stem of one plant joined to root of another.
   Example: mango.

Advantages
Rapid multiplication.
Preserves desirable traits.
Plants mature faster.
Disadvantages
No genetic variation.
Disease can spread easily.
Comparison with Seed Reproduction

Vegetative reproduction
No seed formation.
Offspring identical.
Sexual reproduction
Involves seeds.
Variation present.
Common Examination Traps
Potato is root. Incorrect. It is stem tuber.
Onion is root. Incorrect. It is bulb (modified stem).
Bryophyllum reproduces by root. Incorrect. It reproduces by leaf.
Agricultural Importance
Used in crop production.
Ensures uniform quality.
Used in horticulture.
Concept Linkage
Vegetative reproduction supports fast plant multiplication.
Useful in plants where seeds are not viable.

Concept 6: Crop Production and Agriculture

Definition
Agriculture is the practice of growing crops and rearing animals for human use.
Crop
Definition
Plants grown on a large scale for food, fiber or other uses.
Examples
Rice
Wheat
Maize
Mustard
Cotton
Types of Crops

1. Kharif Crops

Grown in rainy season.
Sown in June–July.
Harvested in September–October.
Examples
Rice
Maize
Cotton

1. Rabi Crops

Grown in winter season.
Sown in October–November.
Harvested in March–April.
Examples
Wheat
Mustard
Gram

1. Zaid Crops

Grown in summer between Rabi and Kharif.
Example
Watermelon
Agricultural Practices

1. Preparation of Soil

Ploughing
Loosens soil.
Improves aeration.
Helps roots grow easily.
Tools
Plough
Hoe
Tractor

1. Sowing

Healthy seeds selected.
Seeds sown at proper depth and distance.

1. Adding Manure and Fertilizers

Manure
Natural substance made from animal waste and plant remains.
Improves soil structure.
Fertilizer
Chemical substance providing specific nutrients.
Example: urea.

1. Irrigation

Supplying water to crops.
Methods
Traditional methods
Canal
Tube well
Drip irrigation
Sprinkler system

1. Weeding

Removal of unwanted plants.
Weeds compete for nutrients.
Weedicides used to control weeds.

1. Harvesting

Cutting of mature crops.
Done manually or using machines.

1. Storage

Grains stored in dry and ventilated places.
Prevents damage by pests and moisture.
Agricultural Tools
Plough
Used for digging and turning soil.
Hoe
Used for removing weeds and loosening soil.
Seed drill
Sows seeds uniformly.
Importance of Agriculture
Provides food.
Provides raw materials.
Supports economy.
Common Examination Traps
Rice is Rabi crop. Incorrect. It is Kharif crop.
Plough used for harvesting. Incorrect. It is used for soil preparation.
Fertilizer and manure are same. Incorrect. Manure is organic; fertilizer is chemical.
Concept Linkage
Healthy soil leads to healthy plants.
Proper agricultural practices increase yield.

Concept 7: Plant Adaptations

Definition
Plant adaptation is a structural or functional feature that helps a plant survive in its habitat.
Desert Plant Adaptations
Environmental Conditions
High temperature
Low rainfall
Scarce water
Adaptations
Thick waxy coating on leaves
Reduces water loss.
Leaves modified into spines
Reduce transpiration.
Protect from animals.
Fleshy stem
Stores water.
Example: cactus.
Deep or widespread roots
Absorb maximum water.
Reduced number of stomata
Minimize water loss.

Aquatic Plant Adaptations
Environmental Conditions
Abundant water
Floating or submerged habitat
Adaptations
Floating leaves
Broad and flat for maximum sunlight.
Example: lotus.
Air spaces in tissues
Help plant float.
Flexible stems
Withstand water currents.
Stomata present on upper surface in floating plants.
Submerged plants
Thin ribbon-like leaves.
Example: hydrilla.
Terrestrial Plant Adaptations
Forest Plants
Tall trees
Reach sunlight.
Broad leaves
Capture maximum light.
Climbers
Weak stems, climb on support.
Example: pea plant.
Grassland Plants
Narrow leaves
Reduce water loss.
Extensive root system
Absorb water from large area.
Mountain Plant Adaptations
Conical shape
Snow slides off easily.
Needle-like leaves
Reduce water loss.
Thick bark
Protection from cold.
Example
Pine.
Mangrove Plant Adaptations
Grow in marshy soil.
Breathing roots grow upward to obtain oxygen.
Roots provide support in soft soil.
Epiphytes
Grow on other plants but do not take food from them.
Example: orchid.
Absorb moisture from air.
Insectivorous Plants
Grow in nitrogen-deficient soil.
Trap insects to obtain nitrogen.
Examples
Pitcher plant
Venus flytrap
Common Examination Traps
Cactus has large leaves. Incorrect. Leaves are modified into spines.
All aquatic plants have stomata on lower surface. Incorrect. Floating plants have stomata on upper surface.
Mangrove roots grow downward only. Incorrect. Breathing roots grow upward.
Advanced Understanding
Adaptation is linked to climate and availability of water.
Structure of plant organs changes according to habitat.
Concept Linkage
Photosynthesis, transpiration and reproduction depend on adaptation.
Survival of plant species depends on successful adaptation.