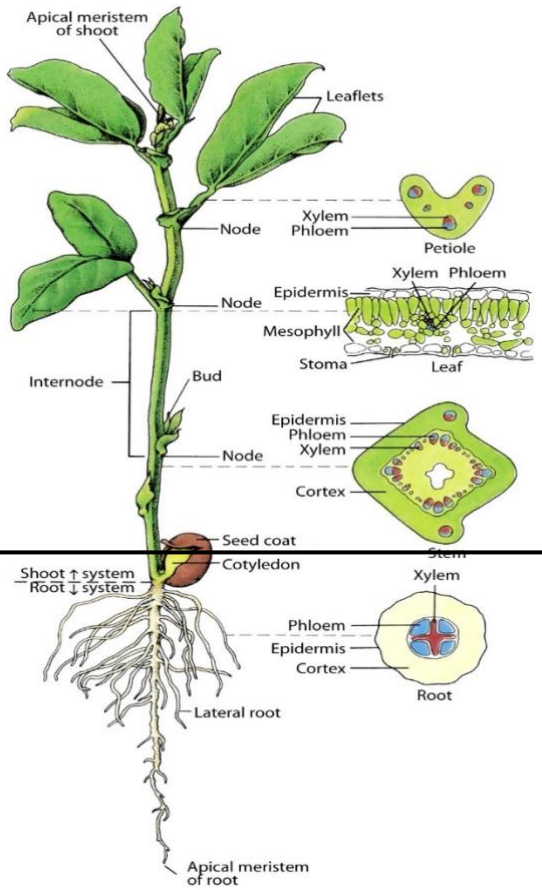
Plant physiology is the study of how different parts of plants function. It includes many aspects of plant life, including nutrition, movement, and growth.

Closely related fields include plant morphology (structure of plants), plant ecology (interactions with the environment phytochemistry (biochemistry of plants), cell biology, genetics, biophysics and molecular biology.

Plant morphology

1-Shoot system

- Stem
  - Supports and places leaves
  - Transports H_2O and nutrients
- Leaves
  - Photosynthesizers
  - Reproductive structures



2-Root system

- Anchors plant
- Absorbs water and minerals
- Storage (CHO) & synthesis of some hormones

3- Major tissue systems make up the plant body

1. Ground tissue
   - cortex
   - mesophyll
   - pith
2. Vascular tissue
3. Dermal tissue

- Tissue systems are continuous throughout the plant

Solutions

Mixtures

- Mixtures are combinations of substances that are not bonded together and can be separated by physical processes

Heterogeneous Mixtures

- Heterogeneous mixture- type of mixture where substances are not mixed evenly
- Ex. Oil and water

Homogeneous Mixtures

- Contains two or more substances that are evenly mixed on a molecular level but still are not bonded together
- Ex: Sugar water and salt water.

Solution: is ahomogeneous mixture of two or more subastances mixed evenly at molecular level one part is regarded as the solute and the other as the solvent.

Solute: a substance that is dissolved to make a solution.

- Ex. Salt, sugar, cupper, sulfate ($CuSO_4$) and CO_2.

Solvent: is a substance that dissolves a solute.

- Ex. Water, Alcohol and Gas.
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Solubility: is a chemical property referring to the ability for a given substance, the solute, to dissolve in a solvent at a given temperature.

The solubility of a solute can be increased in the following ways :

- 1-Heating: ex. More sugar can be dissolved in hot water than in cold water.
- 2-Stirring: ex. More sugar dissolves in the glass that is stirred.
- 3-Solute in powdered form: ex. Crushed sugar dissolves more in water than in sugar cubes.

Types of Solutions

- ❖ According to the type of the matter, there are three types of solutions:
- ❖ **Liquid Solution:**
- ❖ **Solid solution**
- ❖ **Gaseous solution**
- ❖ Liquid solutions: the most common liquid solution is Aqeouse solutions in which the solvent is water.

- **Liquid-liquid**: vinegar and water
- **Liquid-solid** : salt and water, sugar and water.
- **Liquid and gas**: soda (soft drinks), sea water.

Types of Solutions

- ❖ Solid solutions: when the solvent is solid

- **Solid-Liquid**: mercury and gold, mercury with tin and silver (amalgam)
- **Solid-Solid**: steel, alloys (combination of metals)

- ❖ Gaseous solution
- **Gas-gas solution**: Air (nitrogen, oxygen and other gases)

According to the properties of the solution, there three types of solutions.

- **True solution**
  - The solute dissolves completely in the solvent.
  - Homogeneity: true solutions are always homogeneous.
  - Particles cannot be filtered out through filter paper.
  - Particles not visible to the naked eye (<1 nm).

- **Colloidal solution**
  - Particles distributed uniformly in the solvent
  - Heterogeneity: colloidal solutions are heterogeneous.
  - Particles can be filtered out through filter paper.
  - Particles not visible to the naked eye (1-1000 nm).

Types of colloidal solutions according to affinity to water

Hydrophilic colloids (Hydrocoloids)

- Colloid particles are hydrophilic polymers dispersed in water and can be reversible and irreversible.
- Agar can be dissolved in water by heating and solidified by cooling.

Hydrophobic colloids (emulsion)

- Defined as a colloid system where the particles are hydrophobic polymers and do not mix with water.
- Oil and water cannot be mixed since water is polar while oil is nonpolar.

Suspensions

- The solute particles do not dissolve in the solvent, the particles do precipitate.
- Heterogeneity: suspensions are heterogeneous.
- Particles can be filtered out through filter paper.
- Particles are visible to the naked eye (>1000 nm).

Copper sulfate (CuSO4)
True Solution

Milk

Colloidal Solution

Soil and water

Suspension

Experiment

- **True solutions:**

  Dissolve 5 grams of sodium chloride in 25 ml of water.

  Dissolve 5 grams of sugar in 25 ml of water.

- **Suspension solutions:**

  Add 5 grams of sand to 25 ml of water and mix it.

- **Hydrophilic colloidal solutions:**

  Dissolve 200 mg of starch in 25 ml of water.

  Dissolve 200 mg of agar in 25 ml of water.

- **Emulsion solutions:**

  Add 5 ml of oil to 25 ml of water and mix it.