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## Introduction

Water is an important factor for plant growth as it helps to ful ll all the vital activities of plants. Water is essential for photosynthesis, respiration, absorption of minerals and nutrients, metabolism and even to maintain the soil temperature too. Beside this, water is also important in various other processes too, as it helps in the germination of seeds and in the process of transpiration etc. Water helps a plant by transporting nutrients through the roots. Nutrients are drawn from the soil and used by the plant [1]. Without enough water in the cells, the plants droop so water helps a plant stand. Water carries the dissolved sugar and other nutrients through the roots. Plants absorb water through their entire surface- roots, stems and leaves. However, the majority of water is absorbed by root hairs.

### Physical Properties of Water

As per studies on global water covers about 73% of earth's surface and provides the most extensive medium for all aquatic life because of its unique properties from ecological point of view. Water occurs in in all three physical forms in the earth at moderate temperature. It is present in either in the form of fresh water or in saline water form in sea and salt lakes [2]. e fresh water of active ground water, glaciers and ice caps, rivers, lakes dams, streams, soil moisture etc. represents only 1.92% of the total water stock. But even from this small segment as much as 98.65% is shared between active ground water and ice on mountain tops and poles, lakes and rivers constitute only 0.98% and 0.004% fresh water stock respectively.(Figure 1)

### Water Structure and Properties

Water comprises over about 90% of the chemical content of many organisms and so we can say justi ably that water is the uid of life but before this it is necessary to understand the di erent physiological processes related to the di usion and absorption of water, and fundamental chemical and physical properties of water and its interaction with other substances [3]. Water participates in all metabolic reactions either directly or indirectly. Water is a remarkable compound with unique properties that results from its molecular con guration and hydrogen bonding. (Figure 2)

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### Molecular Structure of Water

A single water molecule is composed of two hydrogen atomsbonded covalently to one side of an oxygen atom. Water absorbs large quantity of heat and tolerates other physical stresses without breakage of the bonds. Water is a polar inorganic compound at the room temperature at room temperature associates with each other because of the

their kinetic energy or the net movement from one point to another because of the random kinetic activities of molecules or ions is called di usion [4,5]. Di usion refers to the process by which molecules intermingle as a result of their kinetic energy of random motion. However, the direction of movement of di used particles is form the region of higher concentration to the region of lower concentration till both the concentrations equalize. e molecules in the region of higher concentration contain more kinetic energy and that is why they allow fast movement [6]. e di usion of particles still continues in both the directions though it is not detectable. Di usion is random movement of molecules but has a net direction towards regions of lower concentration in order to reach equilibrium. Simple and passive di usion occurs when small molecules pass through the lipid bilayer of a cell membrane. (Figure 4)

e gases di use through gases. Liquids and solids; liquids di uses through gases, liquids and solids and likewise solids di uses through gases, liquids and solids. In some casesthe rate of di usion may be either very fast or very slow as per the condition. Hydrogen di uses four times faster as far as oxygen and ve times as fast as carbon dioxide, these rates are determined by the relative intensity of the gas.

## Examples of diffusion are

Gas into liquid- Foam, Liquid intogas- Clouds, Solid into gas- Smoke Solid into solid- di usion of copper into zinc and zinc into copper, although this process takes pretty long time, if the basis of two metals are kept one another.

## Osmosis Phenomenon

To explain osmosis if two di erent solutions of di erent concentration are separated by a semi-permeable and will not allow or permit soluble molecules to pass through it. As per the lows of di usion the movement of solvent molecules will be from the region of higher concentration to the region of lower concentration or from dilute solution to concentrated solutions [7,8]. e reason behind this is that the concentration of solvent molecules will lower in the concentrated solution and higher in the dilute solution. On the basis of concentration of solute molecules the solutions may be de ned as hypertonic and hypotonic solutions.

## Exosmosis

Osmosis towards the inside of a cell or vessel or the ow of a substance from an area of lesser concentration to one of greater concentration, while the movement of water molecules from outside to inside of a cell through osmosis is known as endosmosis. Or the process by which water molecules move out of the cell is called exosmosis. A solution is a mixture of two or more than two substance in which the concentration of the solute in solvent may be expressed as weight of solute per unit of solvent or in terms of molarity, normality or equivalent to this.

## Water of Hydration

e water associated with the particles of hydrophilic solutes or colloids is known as water of hydration. An ideal molar solution at 0 0C has an osmotic pressure of 22.4 0 C atmosphere [9,10]. Osmotic pressure increases at higher temperature. Modern workers have substituted the term osmotic pressure by osmotic potential is numerically equal to the osmotic pressure but is negative in sign, which indicates decrease in pressure that occurs due to additionof the solute. When we add more solute the osmotic potential increases more negatively, but dilution of solution with the solvent decreases the value of the osmotic potential. In a solvent the value of osmotic potential is zero. Plant Cell- Asan Osmotic System: e rst cell of the plant which absorbs water and acts like an osmotic system or as an Osmometer is the root hair. e big vacuolated plant cell is an osmotic system waterEc an osmotic
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Due to di usion pressure de cit (DPD) water is absorbed by the root hair. e amount /qualityof water absorbed by the root hair is depends on de cit. If this de cit is greater, larger quantity of water will di use and greater amount of water will enter into the cell. e force per unit area of entrance of water is termed as suction pressure the potentiality of which depends upon DPD, the suction pressure that exists between the cell and environment. It can be said that-

DPD= Osmotic pressure- turgor pressure.

Entrance of water inside the cell a ects it in two ways- i) it brings down the concentration of cell sap and ii) it starches the elastic wall of the cell. is entered water results swelling of cell wall and causes a pressure known as turgor pressure. Due to this, cell increases in volume but due to elastic nature of the wall, o ers resistance to this force. is resistance is works in opposite direction to turgor pressure and known as wall pressure. e wall pressure is exerted by wall in order to restore normalcy in size. e turgor pressure is fully turgid. Water stops to enter or di usion of water molecules in both the directions stops when the concentration of two solutions becomes equal, till the balance is fully stretched and thus entry of water is checked. At this stage cell is fully stretched and is said to be turgid. When osmotic pressure may exist the suction pressure will be zero in a turgid cell.

e entered water decreases simultaneously resulted in an increased turgor pressure and a decrease in osmotic pressure of cell sap. Due to this the concentration di erences simultaneously and brings down the suction pressure. All forces are interrelated and work together.

e water present in the soil may be classi ed as follows-

(i) **Gravitational Water:** e water which reaches deeply into the presss

9. Burton Feldman (2001) The Nobel Prize: A History of Genius, Controversy, and Prestige. Arcade Publishing 12-30.

10. Butler John M (2009) Fundamentals of Forensic DNA Typing. Academic Press 14-19.