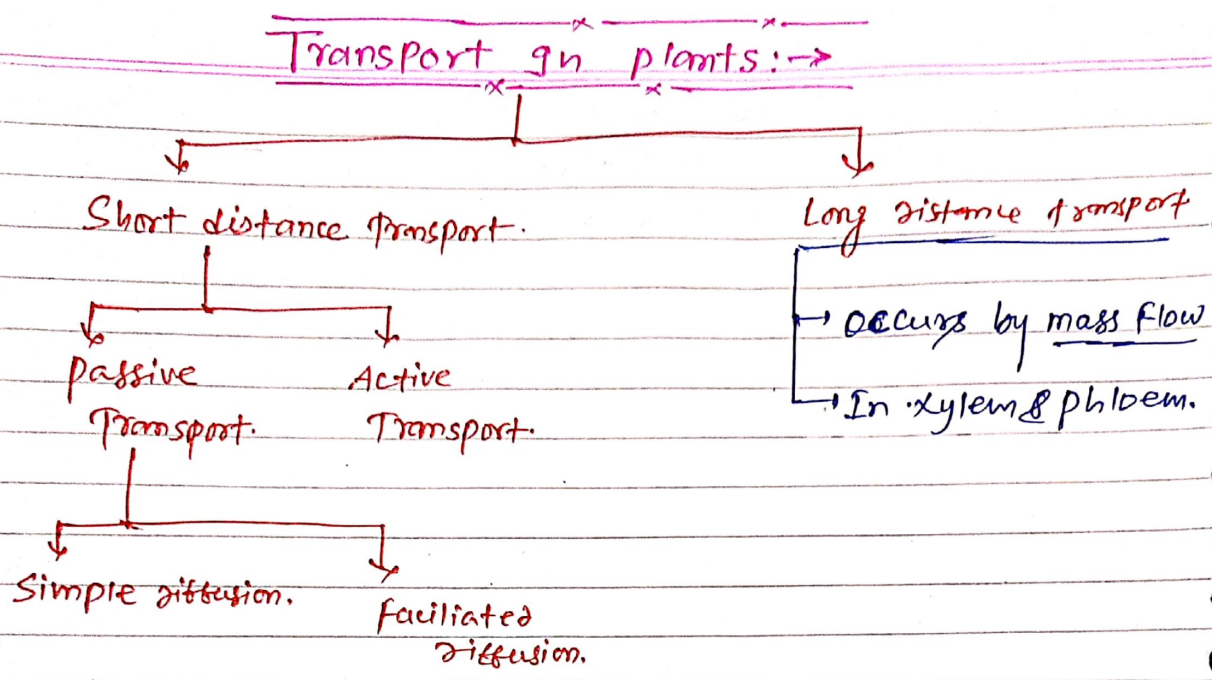


Date : → 27/10/2019



Simple Diffusion: →

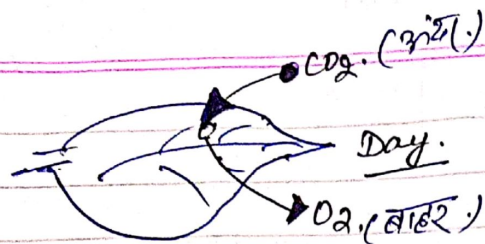
High conc. → Low conc.
[High potential] [Low potential]

→ Simple diffusion may occur through a membrane and without a membrane.

<u>Factor.</u>	<u>Rate of diffusion.</u>
Temp. ↑	↑.
Pressure ↑	↑.
Conc. Difference ↑	↑.

(*) g_l diffusion occurs through membrane than g_t is also affected by membrane permeability.

(*) ⇒ Directⁿ of diffusion is determined by the concⁿ of diffusing molecule g_tself.



There are more chances of diffusion in solid than diffusion of solid.

eg:- Diffusion of water through paper.

* Diffusing molecules hit any surrounding material and they apply some pressure which is called diffusion pressure.

* Diffusion occurs from high DP to low DP.

* Higher is the potential or movement ability of diffusing molecule more is the value of DP.

Facilitated diffusion:-

high concn → Low concn.
across membrane

Through channel proteins.

Eg:- porins → in chloroplasts, mitochondria & prokaryotes.

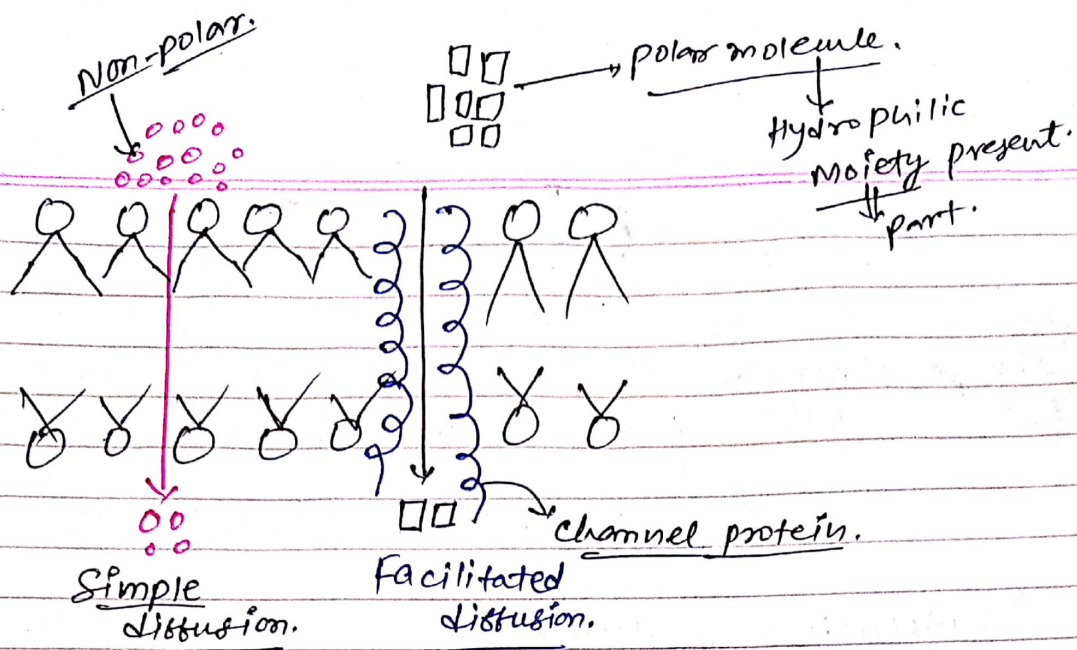
act as anion channels.

Eg:- Aquaporins.

8 types.

water transport.

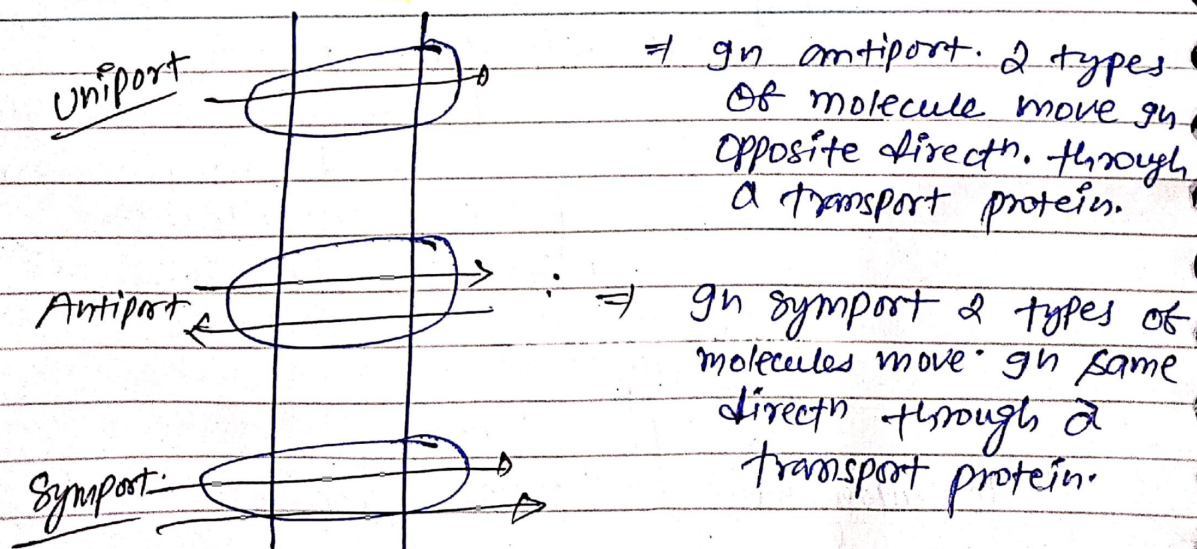
In eukaryotes.



NOTE:- Small amount of polar molecules may pass through membrane without the help of channel protein. When some space is available due to lateral movement of phospholipids.

* facilitated diffusion does not create concn gradient but it utilizes already int gradient.

* Passive transport does not utilise ATP.



Concn gradient $\nearrow$ low to high.

Active Transport.

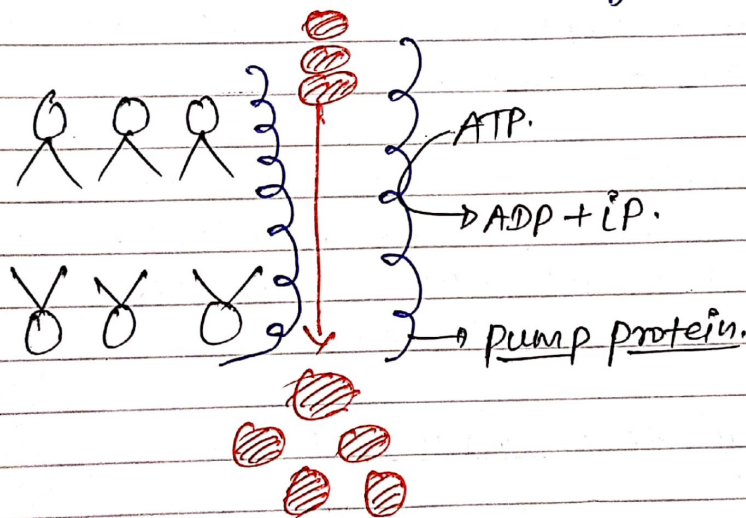
Low concⁿ $\longrightarrow$ High concⁿ
[Low potential] [High pot.].

* Energy supply required.

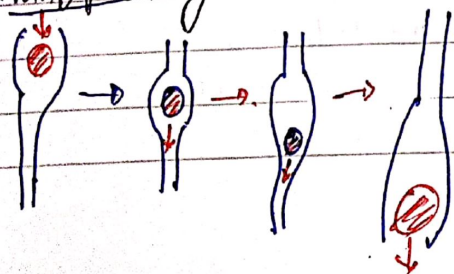
* Occurs through pump protein.

(*) Primary active transport :- ATP is the source of energy.

these ATP are utilised by pump protein.

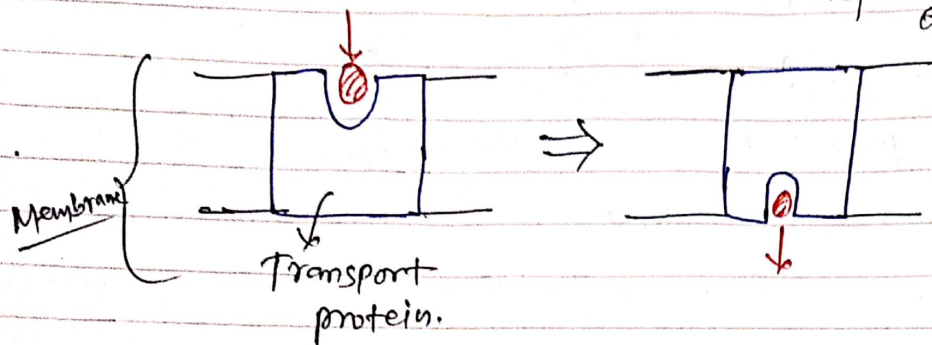


* $\rightarrow$ Conformational changes in pump protein with the help of ATP utilisation are responsible for this active transport. Conformational changes involve shifting of binding site of transporting molecule.



Conformational changes.

Simplified method.



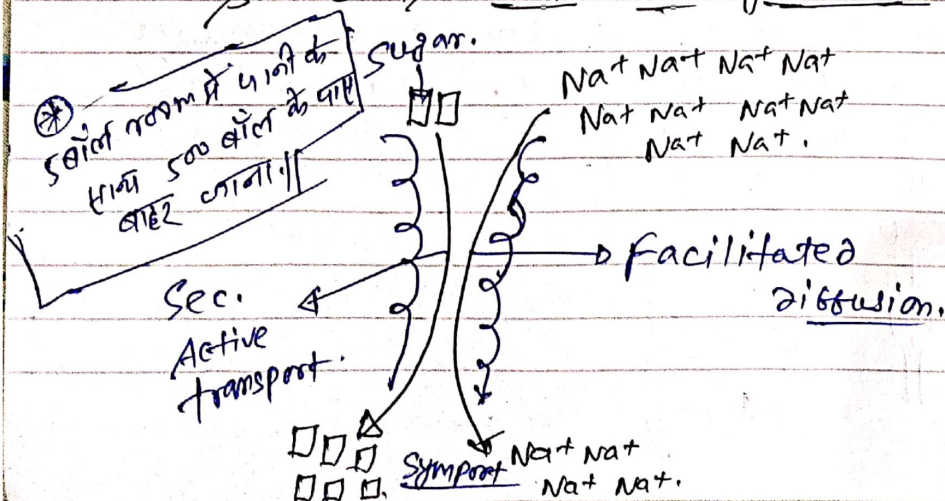
② यह माना है कि इस प्रकार movement प्रोटीन है जिससे प्रोटीन नष्ट हो जायेगा।
यह है। इस प्रकार rotation of प्रोटीन।
प्रोटीन।
conformational change के कारण।
अर्थात् cell में rotation प्रोटीन।
प्रोटीन।

⊗ Comparison of initial and final conformation appears like rotation of transport protein but actually transport has occurred with the help of conformational changes as protein rotation or protein flip-flop movement is not allowed in membrane.

NOTE: → Conformational changes in transport protein also occur in facilitated diffusion but ATP not utilized. as diffusing molecules themselves provide energy.

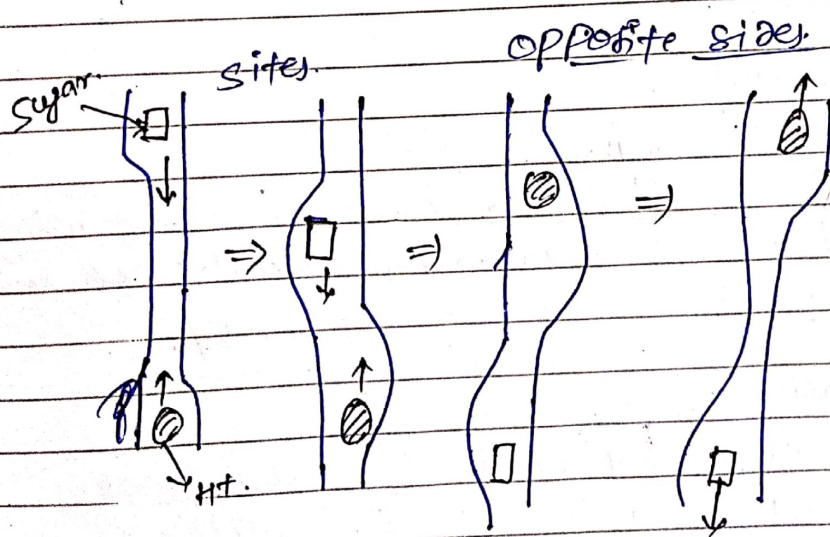
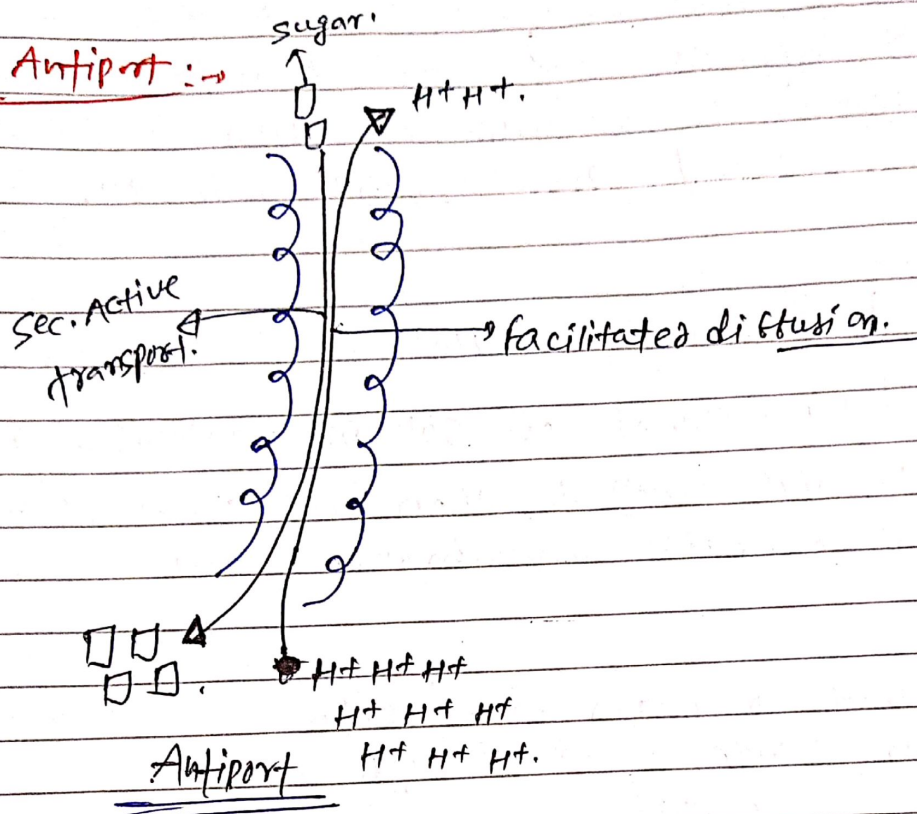
(b) Secondary Active transport →

↳ In this type of active transport energy source is some ion gradient.



⇒ In this case sodium ion concn provides energy for conformational changes in transport proteins.

* Antiport :-



⊗ For Antiport initial binding sites of energy providing ΔG gradient and actively transported molecule must be $\pm$ at opposite sides of transport protein across the membrane. and then they are shifted in opposite direction.

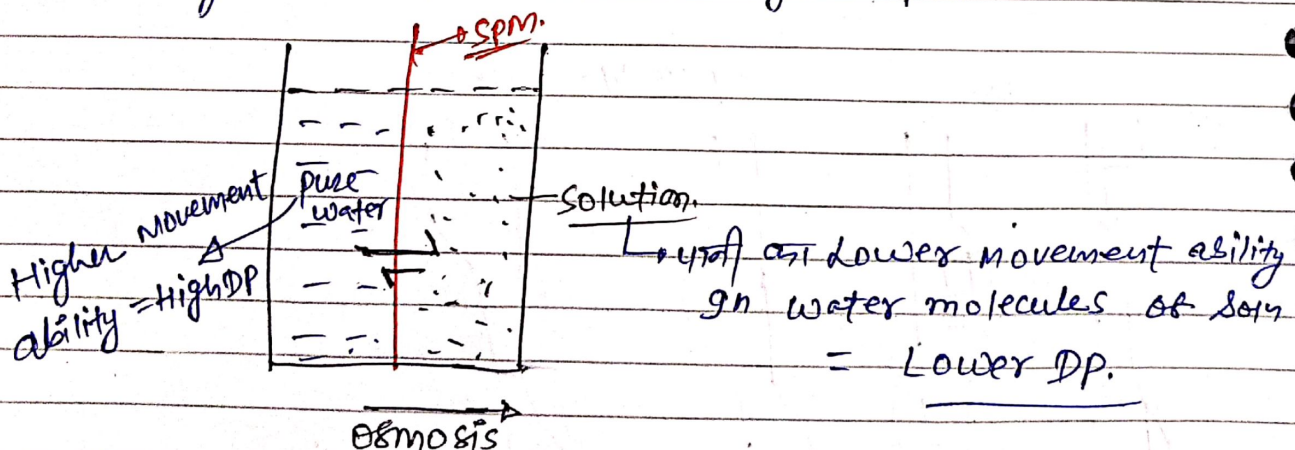
OSMOSIS :-

term by Nollet.

Movement of solvent molecules from their high concn to their low concn through semi-permeable membrane. (SPM)

⊙

Movement of water from lower solute to higher solute concn through SPM.

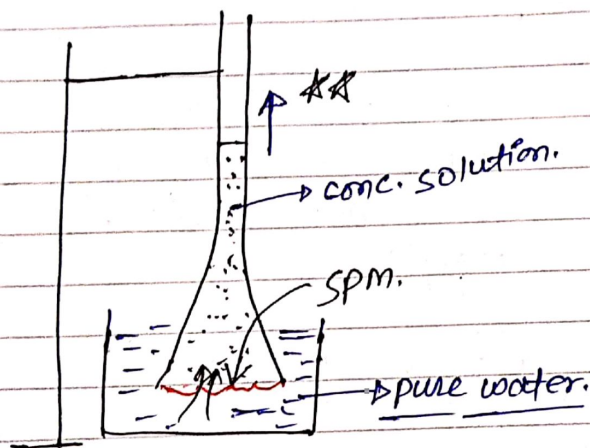


(Pure water is soln is not possible b/c pure water is low solute to soln (High solute))

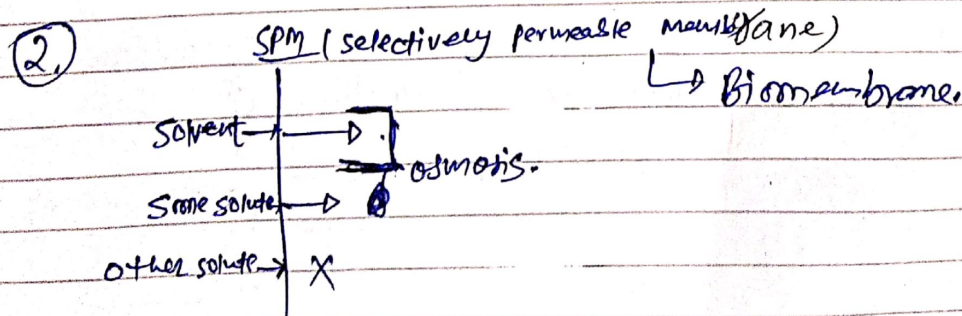
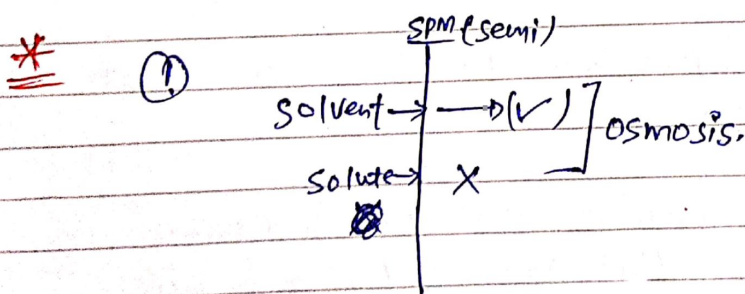
Addition of solute always decreases the potential or movement ability of water molecules.

Osmosis is a special case of diffusion.

=> osmosis can be demonstrated by using a thistle funnel experiment.



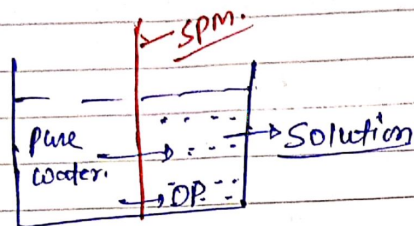
osmosis ⊕
(pure water fl → concn soln)



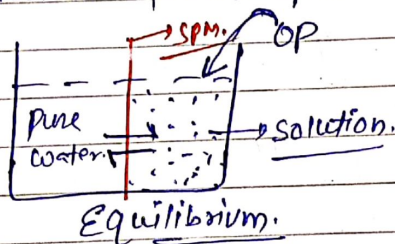
21/01/2019.

Osmotic pressure :- (OP)

- (1) It is the pressure with which osmosis occurs from pure water to a solution.



- (2) It is the amount of pressure applied over soln to just prevent osmotic entry of water into solution from pure water.



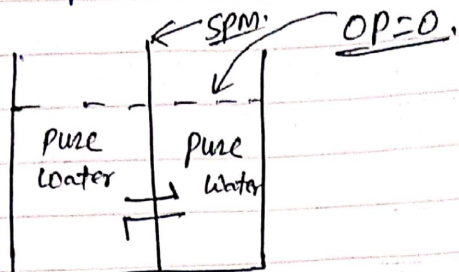
- (3) OP is the diff of DP b/w pure water and solution.

*** Application of pressure increases movement ability or potential of water molecules.

* higher is the concn of a solution, more is the O.P of solution.

soln ki sur osmotik pr kr, osmotik pressure.

* O.P of pure water is 0.



* OP is always measured w.r.t pure water.

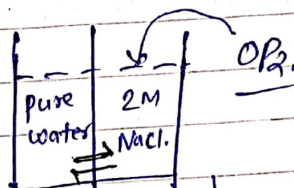
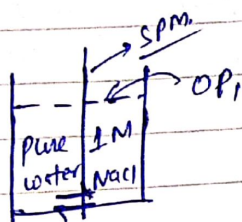
* Water moves from Low O.P to high OP



(pressure
potential)

pressure
(high)

Solute is added

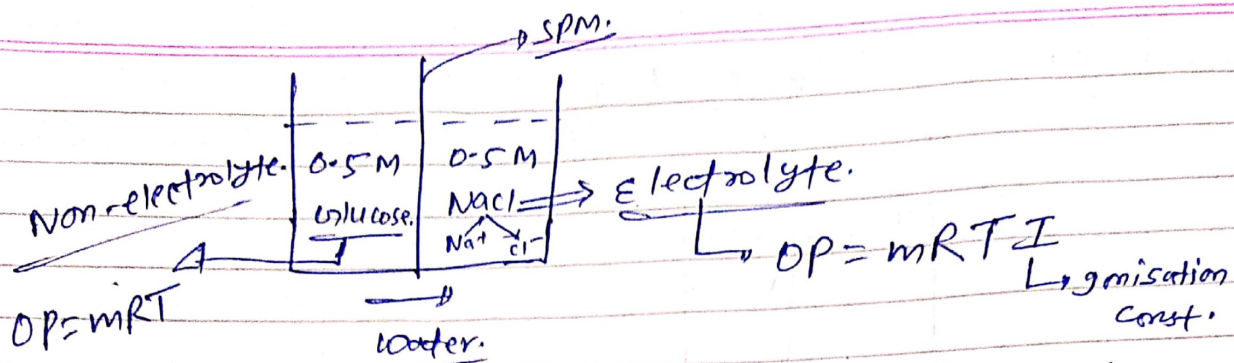


$$OP_2 > OP_1$$

1M NaCl.	2M NaCl.
OP ₁	OP ₂
Soln (low)	Soln (high)

⊗ Lower is the O.P, higher is the movement ability or higher is the D.P.

* O.P is also affected by ionisation of solute.



ionisation increases the actual number of available solute particles due to which movement ability of more solvent molecules is decreased.

- * Halophytes grow in saline area and thus they maintain high solute concⁿ or high OP in their roots to prevent water loss.

Turgor pressure [T.P.]

- * It is the pressure applied by cell content towards outside or pressure applied by water +nt in cell, towards outside.
- * T.P develops in a closed system like a cell.
- * T.P is +ve for turgid cell and there is net +ve pressure towards outside.

+ve value of T.P supports cell growth of cell expansion.

when T.P is +ve it opposes entry of

(18 Oct)

more water into cell.

* $\rightarrow$ T.P is zero for a flaccid cell.

* T.P is -ve for plasmolysed cell. and it results in shrinking of cell membrane.

* Wall pressure: $\rightarrow$ (WP): $\rightarrow$ it is the pressure applied by rigid cell wall against TP.

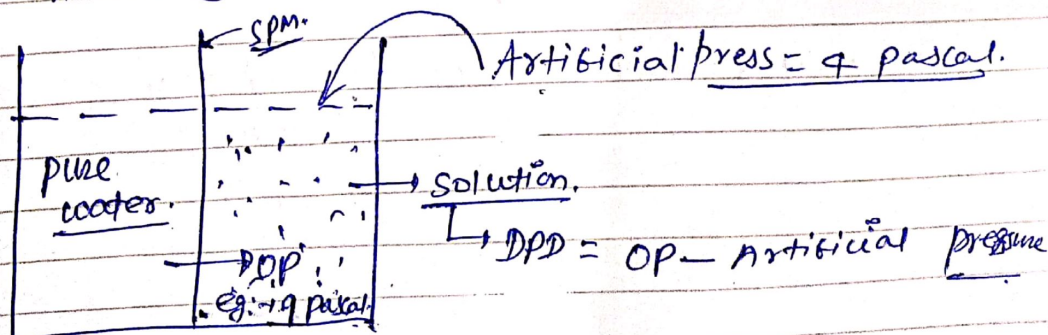
$\rightarrow$ WP prevents cell expansion beyond a certain limit.

$\rightarrow$ It also helps to prevent rupturing of plant cell when placed in hypotonic soln.

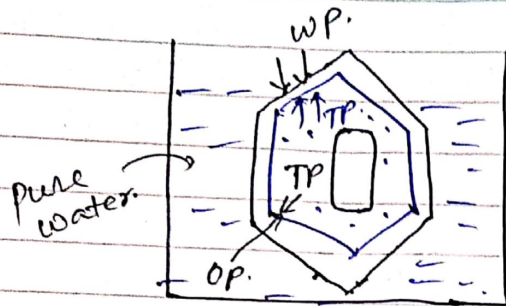
$\rightarrow$ When further expansion is not possible then $WP = TP$.

Diffusion pressure Deficit [DPD]

$\rightarrow$ It is the net deficit or loss in movement ability or DP of water in a cell or in a soln w.r.t pure water.



Plant cell : $\rightarrow \text{DPD} = \text{OP} - \text{TP}$



1# When $\text{TP} = 0$, cell flaccid.

$$\text{DPD} = \text{OP}$$

2# When $\text{TP} = \text{OP}$, cell is fully turgid.

$$\text{DPD} = 0$$

It means that movement ability of water inside cell is equal to pure water when DPD is zero.

Therefore,

$\therefore$ No net entry of water into cell.

3# $\Rightarrow$ When $\text{TP} = -ve$, Plasmolysed cell.

$$\text{DPD} = \text{OP} - (-\text{TP}) = \text{OP} + \text{TP}$$

$$\therefore \text{DPD} > \text{OP}$$

$\rightarrow$ water moves from Low @ DPD $\rightarrow$ High DPD.

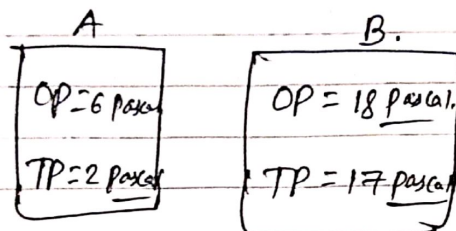
(High movement ability) $\rightarrow$ (Low movement ability)

(High DP.)

(Low DP.)

⑥ DPD is also regarded as water demand of plant cells. As higher is the DPD more is the entry of the water into such cells. therefore DPD is also called succesion pressure.

Q:-



$$DPD = 4 - 1$$

water potential $\rightarrow (\psi_w)$ is the total available free energy of water molecules which can be used for their movement.

* Under normal conditions it is the chemical potential of water molecules.

$\rightarrow \psi_w$ is max^m for pure water and its numerical value is zero.

$$\psi_w = \psi_s + \psi_p + \psi_g + \psi_m$$

↓	↓	↓	└─ matric pot.
Solute potential	pressure pot.	gravitational pot.	

* Solute potential or osmotic potential $\rightarrow (\psi_s)$
└─ this factor is due to the +ve of solute

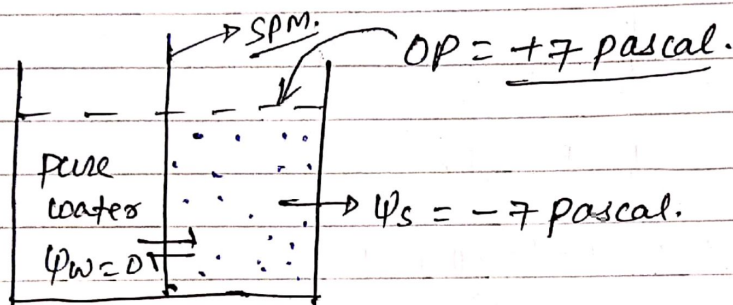
For pure water,

$$\psi_s = 0$$

* for any cell or solution its value is always -ve, b/c addition of solute always decreases the potential.

*
$$\psi_s = -OP$$

osmotic pressure



* * more is the amount of solute lower or more negative is the value of ψ_s .

pressure potential. (ψ_p)

For any cell $\psi_p = TP$

For solution $\psi_p =$ artificially applied pressure.

Atmospheric pressure neglected.

* Gravitational potential (ψ_g)

↳ this factor is due to difference of height.

↳ It is neglected for water movement b/w plant cells.

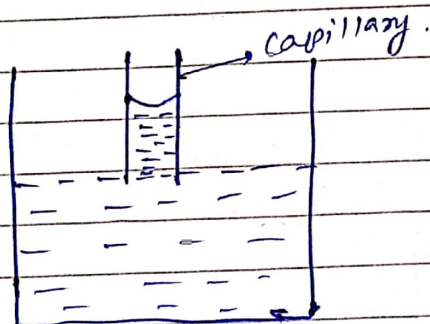
↳ ψ_g can be considered when height diff. is large like water store in a dam.

↳ ψ_g has the ability to make water potential +ve, but ψ_g is physical potential.

* Matrix potential (ψ_m):

→ ψ_m is due to Adherence or Attraction of water molecules over a surface.

→ ψ_m helps in rise of water in a narrow Capillary.

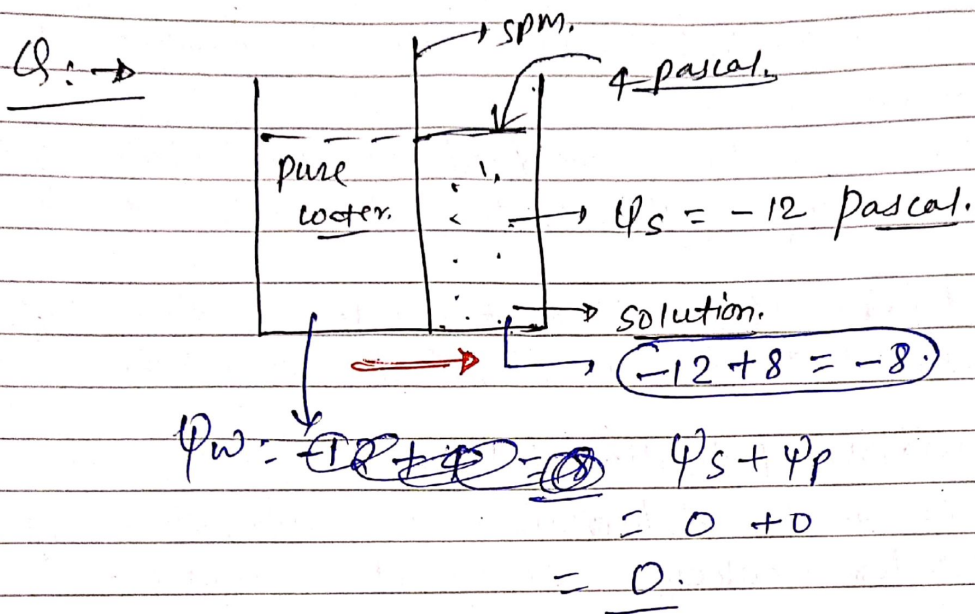


ψ_m is also neglected b/c ψ_m is soon balanced by gravitational pull.

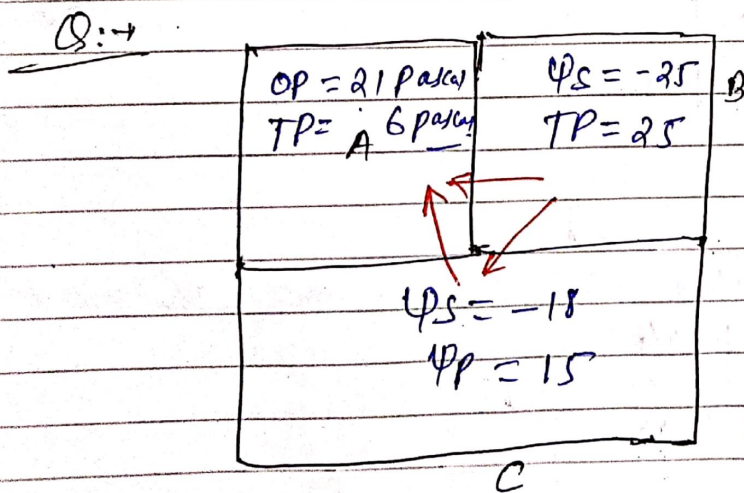
$$\psi_w = \psi_s + \psi_p$$

→ water moves from high ψ_w → low ψ_w .

→ High ψ_w → Low ψ_w .
(less -ve) (more -ve.)



NOTE:- under atmospheric pressure $\psi_w = \psi_s$.
(अनुवाता द्रव्य external pressure रहे तो $\psi_w = \psi_s$)



DPD

$$A = 21 - 6 = 15$$

$$B = 0$$

$$C = \psi_s + \psi_p = -18 + 15 = -3$$

ψ_w
-15
0
-3

$$\psi_w = -DPD$$

07/10/2019.

Imbibition $\Rightarrow$

↳ Adsorption of water molecules.
at a suitable surface.
↳ imbibant.

eg: $\rightarrow$ Entry of moisture into wooden doors in rainy season. $\rightarrow$ concn difference or gradient & imbibant must have affinity for water.

$\rightarrow$ Special case of diffusion.

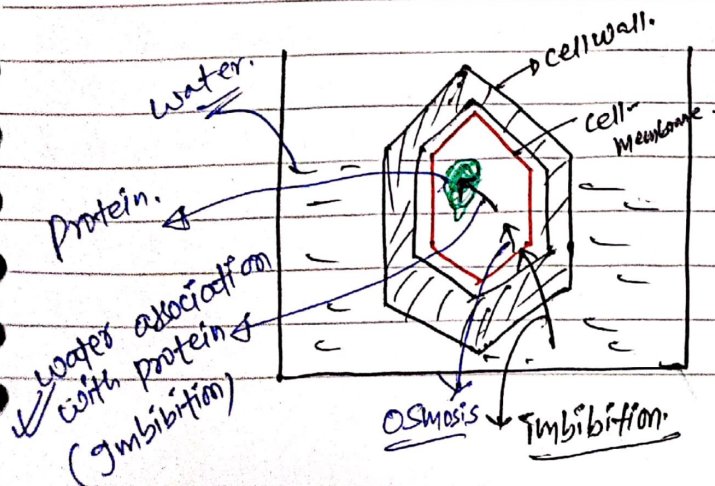
$\rightarrow$ matric potential helps in this process.

Imbibition involves.

↳ volume $\uparrow$.
↳ eg: $\rightarrow$ swelling of dry seeds in water.

Imbibition pressure.

↳ pushes seedlings out of soil.
↳ rupturing of seed coat.



Imbibition $\Rightarrow$ adsorption.

↳ water

ଅବଶୋଷଣ

ପାଣିର ସଂଯୋଗ

ବିଶେଷତଃ ପ୍ରୋଟିନ ସହିତ

→ Imbibition also involves release of heat, which is called heat of wetting. K.E of water molecules is converted into heat energy.

Imbibition capacity:

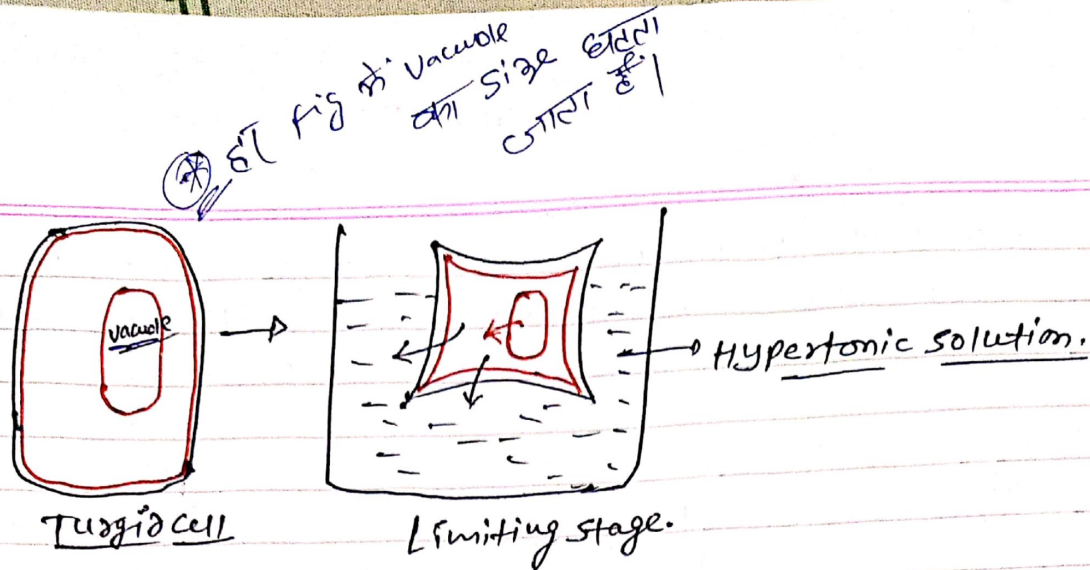
Agar-Agar > pectin > proteins > starch > Cellulose.

- | | |
|--|--|
| <ul style="list-style-type: none">* Dry gram seeds soaked.* Swelling.* Seed coat ruptured.<ul style="list-style-type: none">→ more IP.→ protein rich. | <ul style="list-style-type: none">* Dry wheat grains soaked.* Swelling.* <u>NO seed coat rupturing.</u>* <u>Less IP</u><ul style="list-style-type: none">→ starch rich. |
|--|--|

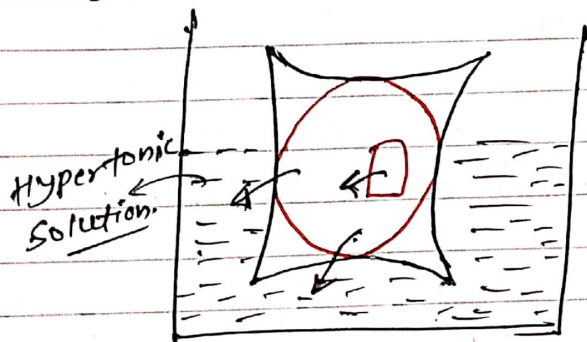
plasmolysis: → It is the phenomenon of loss of water from plant cells or other cells having cell wall, through osmosis, when they are placed in hypertonic solution. Cell membrane is slowly separated from cell-wall.

Stages: →

- i.) Limiting plasmolysis: → due to loss of water some shrinking occurs in c.w but cell-membrane is completely attached with c.w.

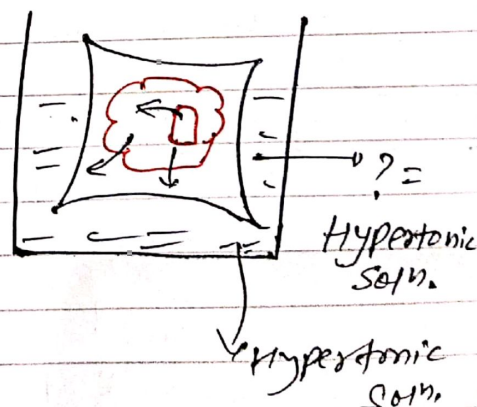


ii.) Incipient plasmolysis: → due to further Loss of water cell-membrane starts separating from cell-wall particularly at the corners of cell.



(iii.) Evident plasmolysis: →

In evident stage cell-membrane is fully separated from cell-wall. but cell is still alive.



Seed के मृत हो जाने पर imbibition होता होता है।
But deplasmolysis नहीं होता है।

iv) Complete plasmolysis:- Due to excessive loss of water protoplasm and cell-membrane properties are lost i.e cell is now dead.

* High salt concn and sugar concn are used as preservatives as they control bacterial (आम्रान को) and fungal infection by complete plasmolysis.

* High concn of salt or chemical fertilizer around the roots of the plant may cause plant death due to plasmolysis.

Deplasmolysis:- If a living plasmolysed cell is placed in hypotonic solution or pure water then it regains turgidity, and this process is called deplasmolysis.

* Transpiration:-

Transpiration is the loss of water from plants in the form of *water vapour*.

A/c to Curtis transpiration is "necessary evil" for plants. (आवश्यक दुर्घटना)
 gas & form it.

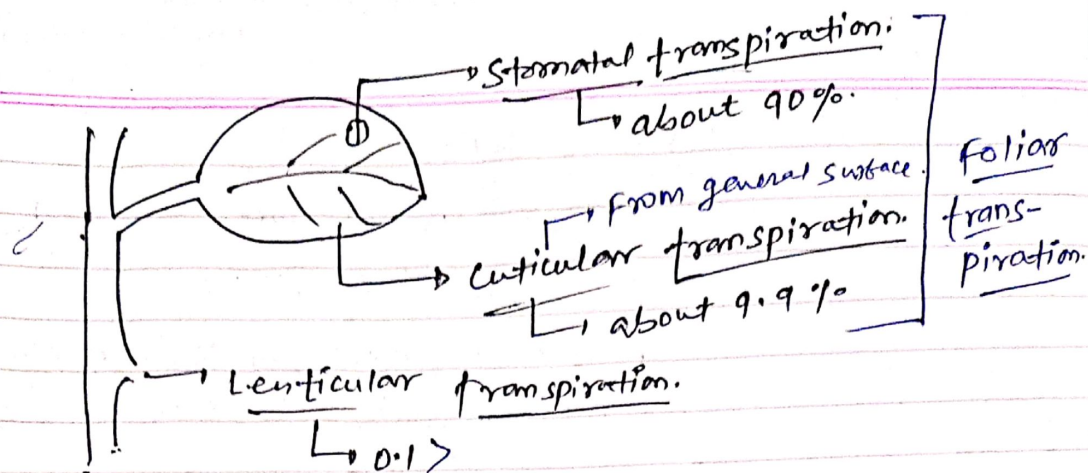
* Cooling effect.

Benefits.

* Transpiration pull for rise of water.

* It helps in re-entry of water into plant cell and thus helps to regain turgidity.

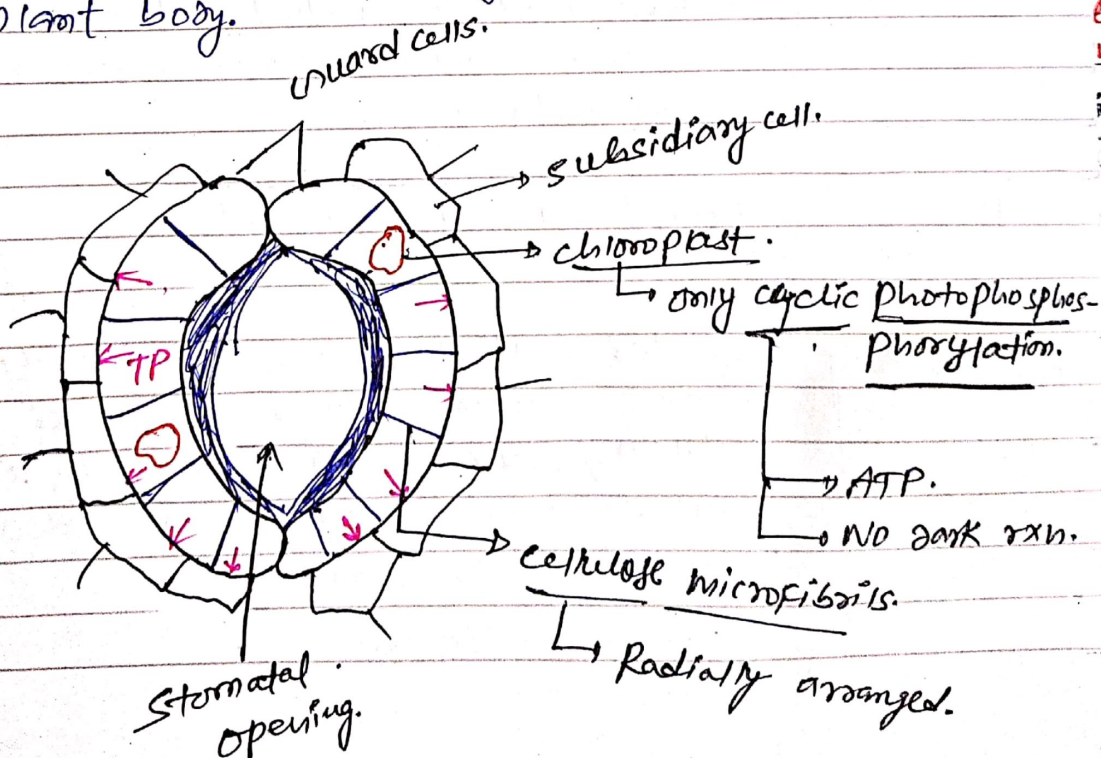
Date :
9/10/2019



- * Submerged Hyrophytes do not show transpiration.
- * Max transpiration is observed in mesophytes.

* Stomata : → Stomata are small-pore over leaves and herbaceous stem, for the purpose of gaseous exchange.
↳ water vapour, CO_2 , O_2 .

* Stomata are found only in sporophytic ($2n$) plant body.



Monocot
1 cotyledon. vein usually parallel. Fibrous root system. Floral parts usually in multiples of three.

Guard cells.

- epidermal cells.
- have chloroplast.
- outer wall is thin & elastic.
- inner wall is thick & elastic.
- Bean / kidney / crescent shaped in dicots.

Dumbbell shapes.

in monocots.

NEET-2018 (in grass. stomata shape is → Dumbbell shape)

When guard cells are turgid.

- TP high
- outer wall is pushed out.
- inner wall is pulled out with the help of cellulose microfibrils.
- Stomata open.

When guard cells are flaccid.

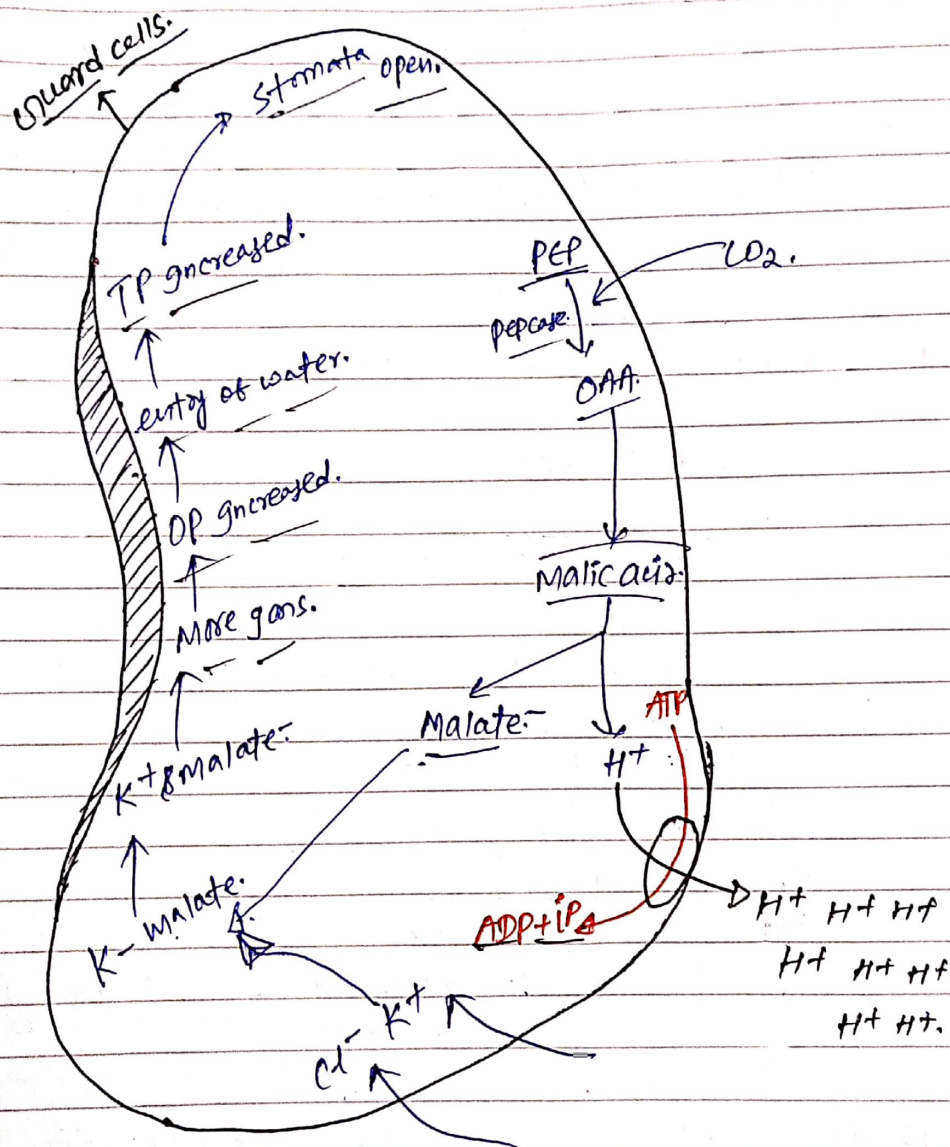
- TP = 0
- outer wall is not pushed out, it's move towards inner side and thus pulling pressure on inner wall is released due to which inner wall also moves towards inner side.
- Stomata closed.

Dicot

Two cotyledons, veins usually net like, Taproot usually present, floral parts usually in multiples of 4 or 5.

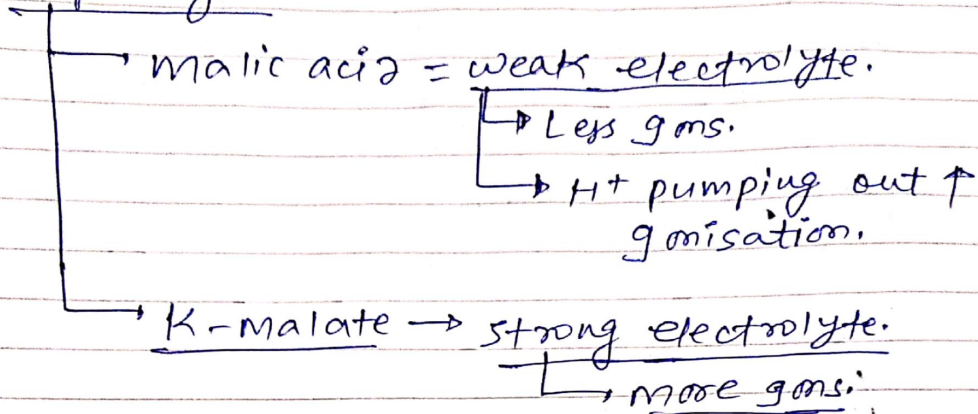
* $K^+ \rightleftharpoons H^+$ theory by Levitt.

↳ explains opening & closing of stomata.

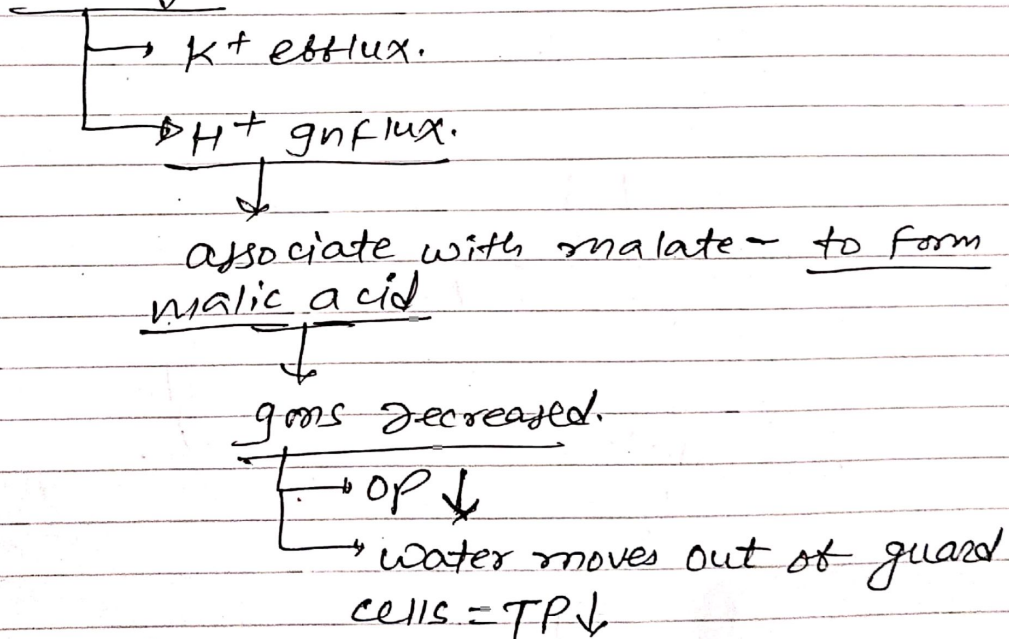


* Malic acid.
↳ weak electrolyte or
orion कम है सो, H^+ remove कम
होगा।

* Opening.



* Closing.



factors affecting rate of transpiration.

↳ also used module theory.

(i.) Humidity:- It is most important factor affecting
transpiration when stomata are open.

→ High transpⁿ = atm-dry + plant moisture ↑
 osphere

When relative humidity of atmosphere is 100% then transpiration does not occur.

(ii) Temperature:-

Temperature: $\rightarrow$ Transpiration $\uparrow$ with temp. $\uparrow$ upto 50°C thereafter stomata closed.

↓ ~~increase~~ increase in temp also increases vapour
holding capacity of atm.

(iii) Wind velocity :-

↳ slow and moderate wind.

↳ Transph ↑

→ High wind velocity.

*stomata closed.

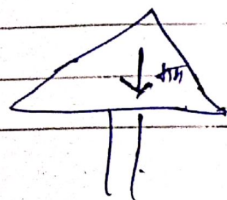
→ transpiration ↓.

(iv) Atmospheric pressure : $\rightarrow$

↓ decrease = transpiration ↑.

(v) Tree - Canopy.

due to difference in surface area.



vii) Light
↳ Blue > Red.

viii) Anti-transpirants.

↳ PMA (phenyl mercuric Acetate)
↳ ABA, CO_2] — induce closing of stomata.
↳ silicon oil, low viscosity wax.

Absorption of water.

Passive.

* Osmotic entry of water into roots is supported by transpiration pull.

* passive water absorption is the main method of water uptake.

Active.

* Osmotic entry of water is supported by active mineral absorption.

* This absorption of water is indirectly active.

forms of water in soil

- | |
|---|
| i) Capillary water: in small pores of soil. |
| ii) Hygroscopic water: thin layer of water over soil particles. |

} Available for chresard plants

(iii) Chemically combined water :-
↳ chemically bond with other compounds.

(iv) Capillary water :-
ground water.

Not available for plants. = Ecard

Holard

* Roots of only some plants are able to reach upto ground water. Eg:- Acacia, Eucalyptus, Calotropis.

Apoplastic & Symplastic movement of water.

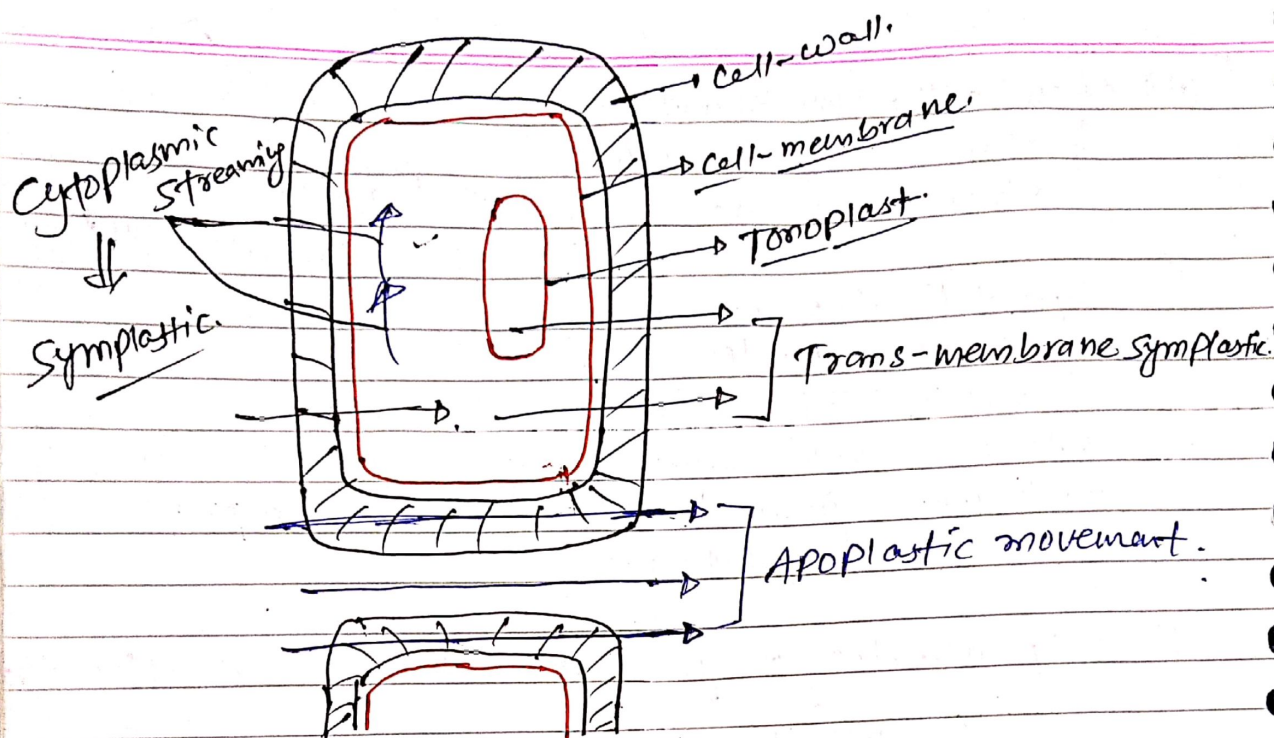
↳ concept by Munch.

Apoplast is the dead content of plant body. including intercellular spaces and cell wall. and water movement through these regions is called apoplastic.

→ Apoplastic movement of water is faster than symplastic.

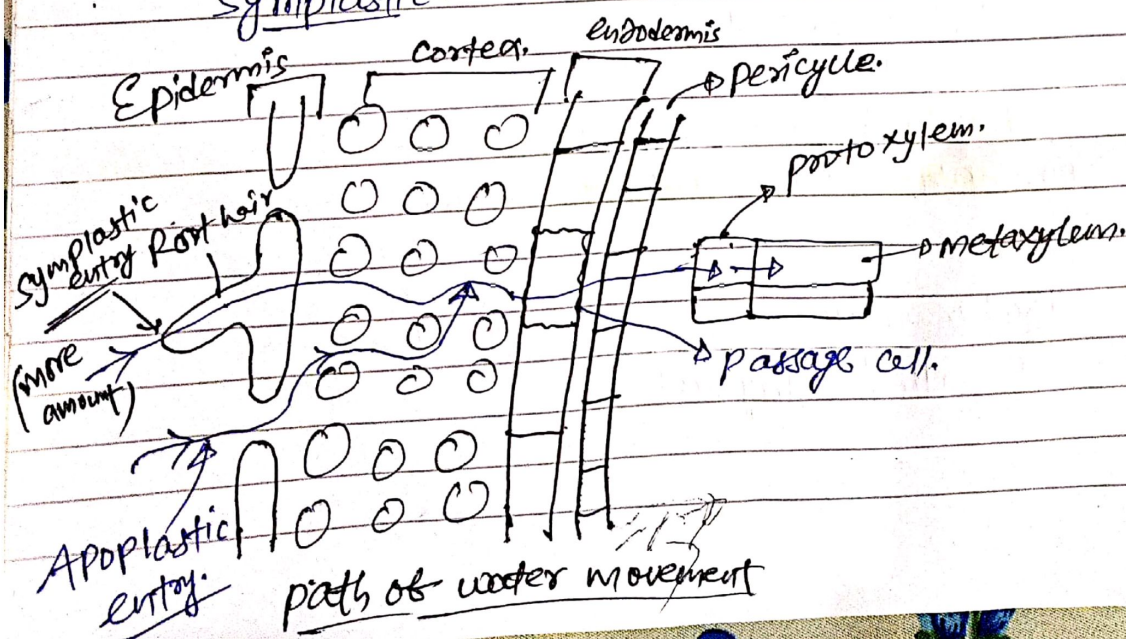
⇒ Symplast is the living content including protoplast, cell membrane and tonoplast.
(vacuole membrane)

Water movement through these regions is called symplastic.

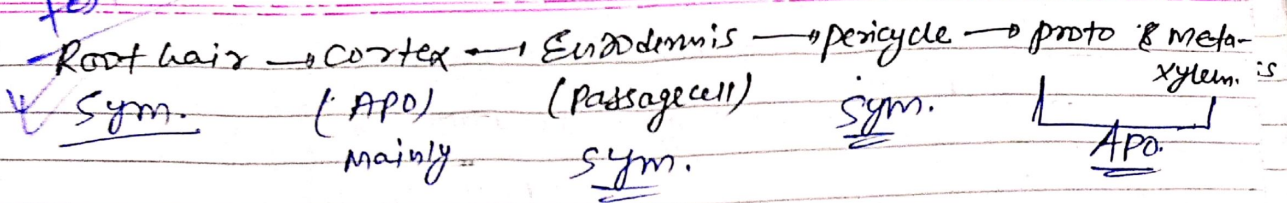


⇒ Cytoplasmic streaming is active process as it occurs with the help of microfilament which utilises ATP. It is movement of cytoplasm within the cell.

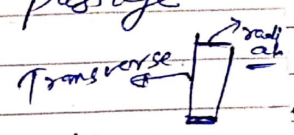
⇒ movement through plasmodesmata is also symplastic.



test +3

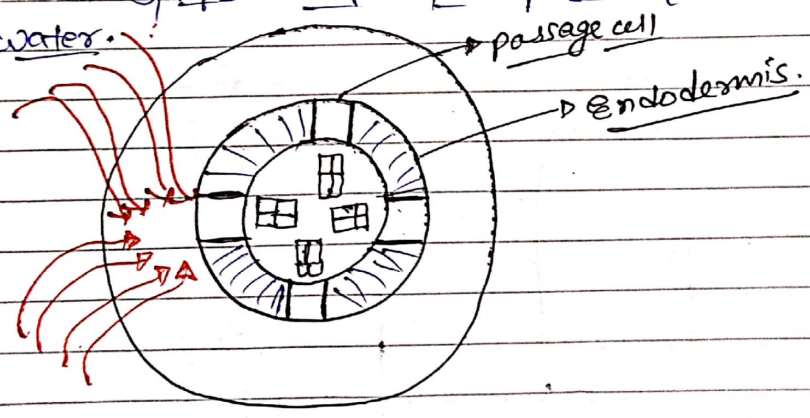


* Endodermis cells have Casparian strip formed of suberin lipid, on their ~~transverse~~ and radial wall, and thus apoplastic passage is not allowed.



* Passage cells do not have Casparian strip. and they allow symplastic passage of water.

* Casparian strips helps to prevent backflow of water.

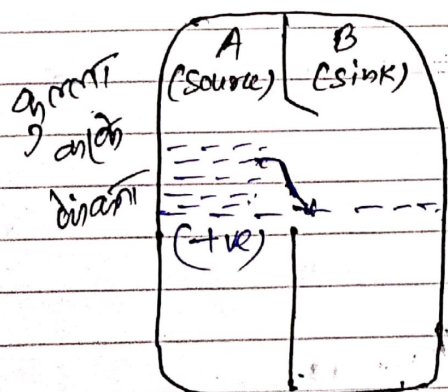


Long distance transport

occurs by mass flow. (en mass ^{समष्टि})
↳ bulk transport.

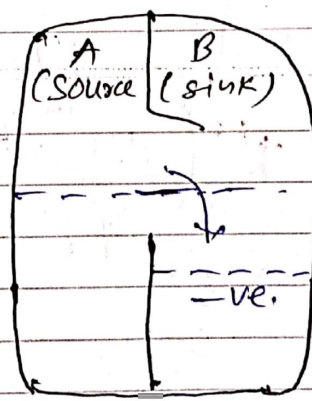
In mass flow material dissolved or suspended in water is transported with the flow of water. and this transport is not dependant upon the concn. of such material.

⇒ Movement of water for supporting long distance transport occurs due to difference of pressure, b/w two positions.



Positive pressure
or
pushing pressure.

eg: → Root pressure.



Negative pressure
(-ve)
pulling pressure.

eg: → Transpiration pull

Increase in pressure
in source generates
pushing pressure.

decrease in pressure at
sink or destination
generates pulling pressure.

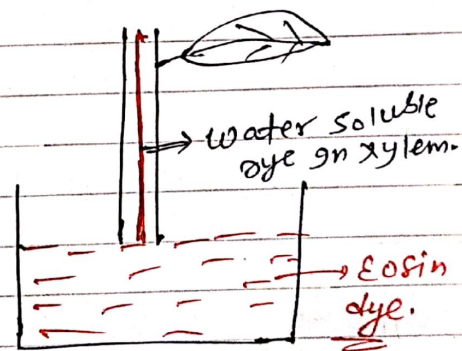
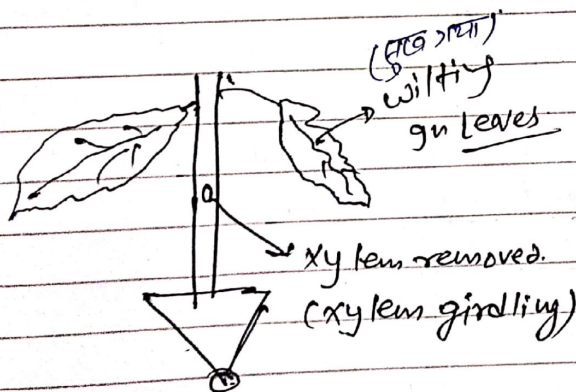
(A) ^{rise.}
Ascent of sap.

→ water + minerals.
+ organic amides
+
plant hormones

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→ rise of water and its

dissolved content occurs through xylem, and it
can be proved by using xylem girdling
experiment, and Balsam twig experiment.
(dead)

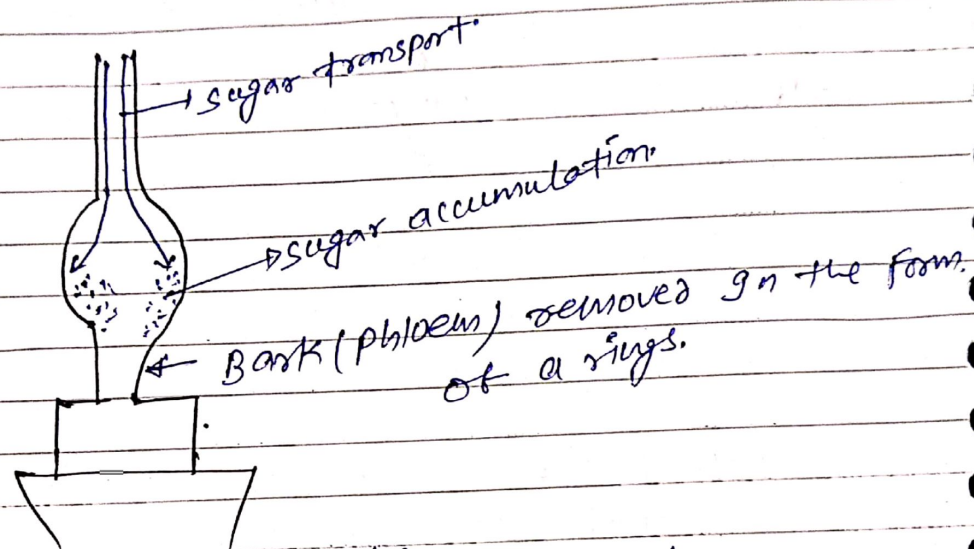


i) Cohesion-tension-transpiration pull theory →
↳ by Dixon & Jolly

→ Transpiratory loss of water from leaves
highly decreases water potential or highly
increases DPD in leaves.

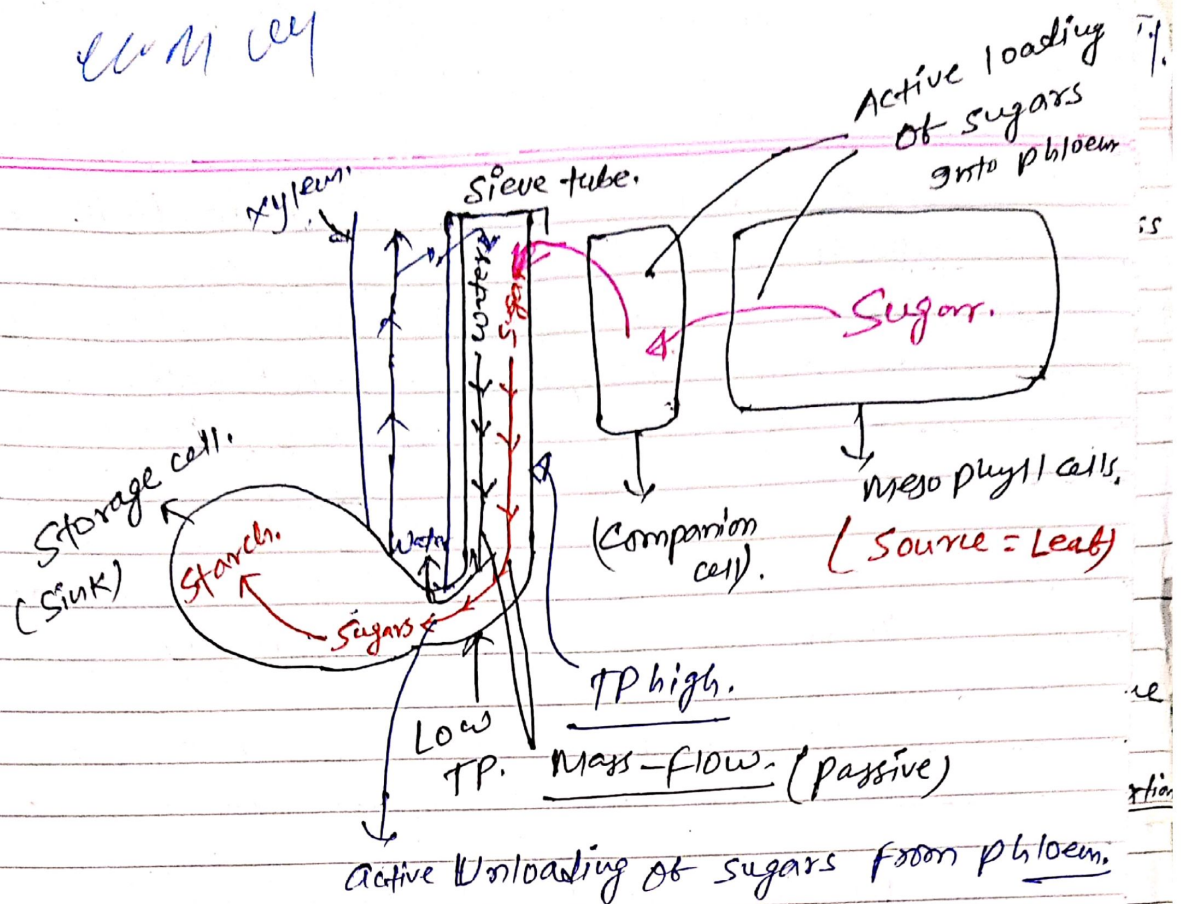
(B.) Translocation of sugars through phloem :-

Grinding or ringing experiment can be used to prove that sugar transport occurs through phloem.



Removal of phloem inhibits sugar transport towards root and it proves that phloem is responsible for sugar transport.

Plant in which such experiment is conducted ultimately dies and roots die early than sugar.



* Sugars are actively removed from mesophyll cells b/c increase in sugar concn in these cells inhibits the photosynthesis.

* Transport from companion cells to sieve tube is also active.

* High sugar concn. inside phloem promotes entry of water from xylem due to which TP or hydrostatic pressure in phloem drops becomes high.

* Sugars are actively removed from the phloem and transported into sink, where sugars are converted in starch which is insoluble in water and does not behave as solute.

* Active removal of sugars from phloem is necessary so that low solute concn in phloem is maintained and it helps in moving water throughout the phloem and thus t.p in phloem closed to sink remains flow.

* Sucrose is the most common transport sugar, it is unknown reducing sugar.

* Stachyose, verbascose & Raffinose are the minor transports. sugars in plant.

phloem pH is alkaline. (about 8)

* In sugarcane sucrose is the storage sugar which is water soluble and its reserves in water accumulation.

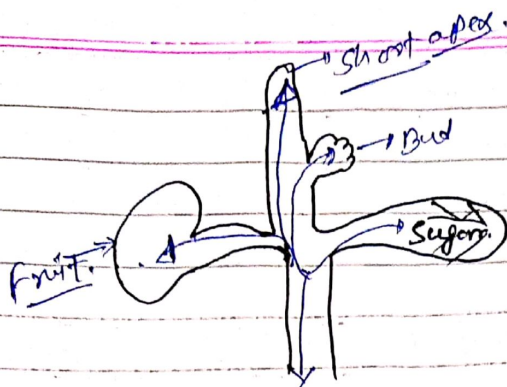
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✓ * Sugar transport in phloem is bidirectional.

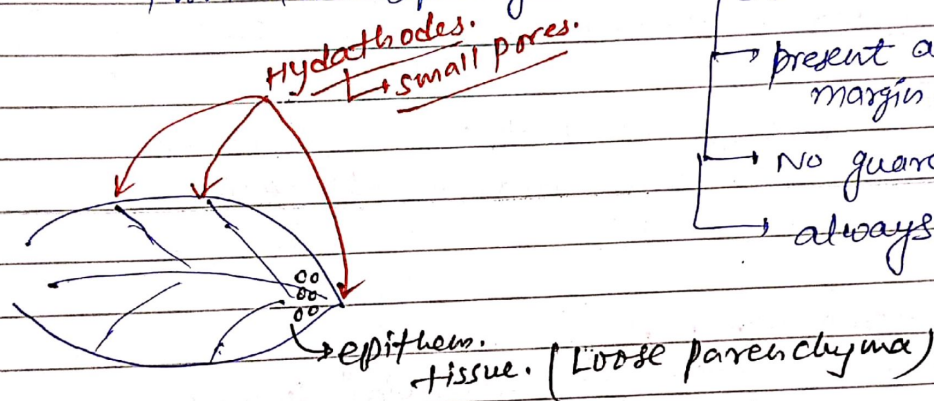
NCERT

↓ * Sugar transport is mostly from leaves to roots. But if required then stores sugars can be hydrolysed into simple sugars and transported upwards, with the help of upthrust in the phloem.

* Sugar transport in complete plant is multi-directional.



Guttation :-
 Loss of water & dissolved content = (Sap)
 from the opening called hydathodes.



- present at leaf margin.
- No guard cell.
- always open.

→ Guttation occurs due to root pressure.

→ Guttation is observed in night time and morning and only in small plants.

→ During guttation water potential of leaves is almost zero.

** Bleeding/Exudation :- Release of liquid content from any cut or injury in plant.

→ It has commercial importance.

Ex: → Release of gums
" " Latex from rubber plant.
" " " " opium plant.

→ Sugar syrup from toddy palm (*Caryota urens*).
↳ fermentation → Toddy.

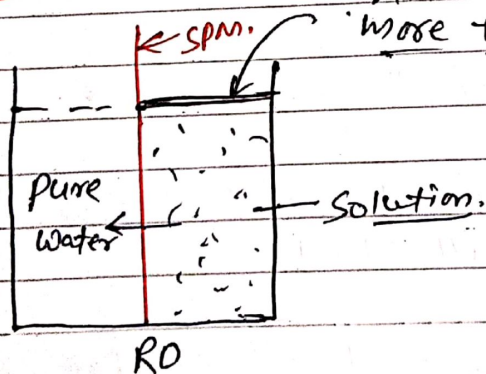
Note: → potometer: → Measurement of rate of transpiration.

Manometer: → Measurement of root pressure.

Cobalt chloride paper test: → comparison of
rate of transpiration ~~through~~ 2 surface
of leaves.

Reverse osmosis: → (RO)

Artificial pressure
more than OP.



It is the movement of water from soln to pure water through SPM when pressure more than OP is artificially applied over soln site.

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corrected
dia: →
plasma membrane (X)
↓
cell wall (✓)

During RO water potential of so_m is +ve.
This process is used for obtaining fresh-
water from saline water. and also used for
water purification.