

General botany

1st Year science

2023

Physiology

(practical)

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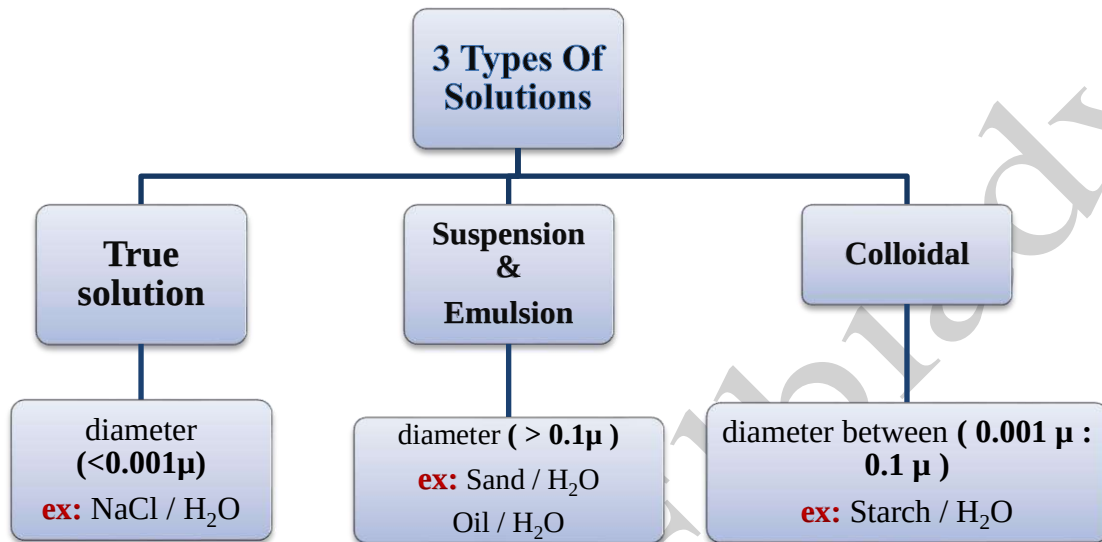


Sec 1

➤ **Solution** → mixture of one substance dissolved in another.

- **Solution = Solute** مذاب + **Solvent** مذيّب

➤ **Types of solution:** (According to the diameter of solute particles)



NOTE :

1) When **dispersed phase (solute)** is **solid** → system called **Suspension**. → Sand / H₂O

2) When **dispersed phase** is **liquid** → system called **Emulsion**. → Oil / H₂O

➤ **colloidal solution:** heterogenous soln in which the size of dispersion phase is in range (0.001 μ : 0.1 μ)

➔ Colloids are **dissolved state** of substances that either **don't** pass, or pass **very slowly** through a **parchment paper** or **animal membrane**.

➤ **Colloidal Soln = dispersed phase + dispersion medium**

➤ **Types of colloids**

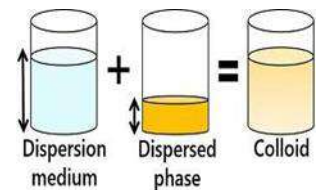
- Based on physical state of **dispersed phase & dispersion medium**

Colloids can be classified into different types.

e.g. sols.

- **In Sols** → dispersed phase : **solid**

dispersion medium : **liquid**.



1. Depending on **Nature Of Interaction** between **dispersed phase & dispersion medium** **sols** can be classified into **2 types**.

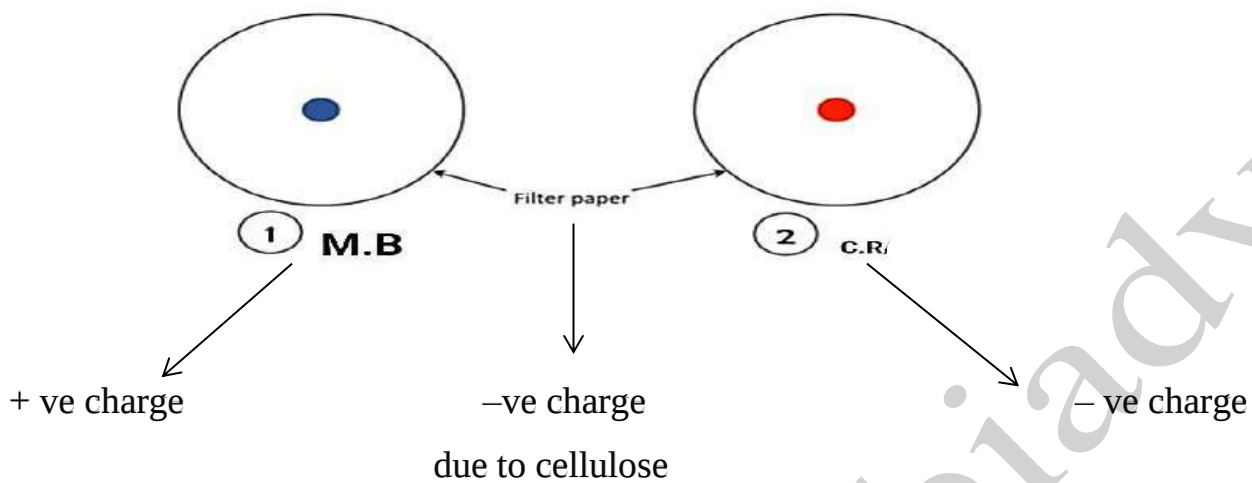
1) Lyophilic sols

2) Lyophobic sols

	Lyophilic colloids = intrinsic colloids	lyophobic colloids = extrinsic colloids
Nature	- Organic in nature. - Surround itself with a membrane of dispersion medium (water).	- Metallic in nature. - Not surround with dispersion medium (water)
Viscosity	- More viscous.	- Less viscous.
Electrical charges	- Carry positive (+ve)or negative (-ve) or neutral.	- Carry positive or negative charge (never be neutral).
Electrophoresis	- Migrate to cathode or anode. - may not move at all (if it neutral)	- Migrate to cathode or anode
Stability	- Relative stable	- Unstable
Precipitation	- Not easily precipitated "due to water film".	- Easily precipitated.
Reversibility	- Reversible when ppt	- Irreversible when ppt.
Example	- Gelation/H₂O	- FeCl₃ / H₂O

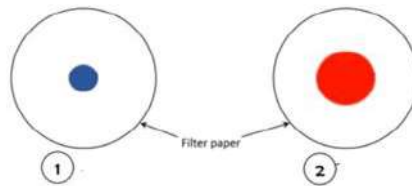
➤ Electrical Charges on Colloidal Particles

➤ procedure



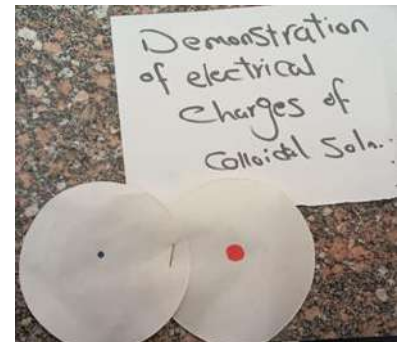
• Observation:

- ✓ M.B doesn't spread leaving only water to diffuse.
- ✓ Congo red spreads together with water.



• Comment:

- Colloidal particles have **definite type of electrical charge**.
- All colloidal the same type particles Carry the same type of charge,
- Colloidal Sols (+ve charged or -ve charged).
- **e.g : Positively Charged Sols** → $\text{Fe}(\text{OH})_3$, $\text{Al}(\text{OH})_3$, $\text{Cr}(\text{OH})_3$, haemoglobin & **basic dyes as methylene blue**
- **e.g. Negatively Charged Sols** → Au , Ag , Cu & metal sulphide sols as As_2S_3 كبريتيد الزرنيخ الثلاثي , CdS كبريتيد الكاديوم , starch sol, cellulose , **acid dyes**
- Particles of **methylene blue (+ve charge)** are adsorbed on cellulosic filter paper (-ve charge)(**Attraction**) So not spread → while **water only spreads** by **capillarity**.
- Particles of **Congo red (-ve charge)** aren't adsorbed on cellulosic filter paper (-ve charge) (**repulsion**) → So spread together with water.

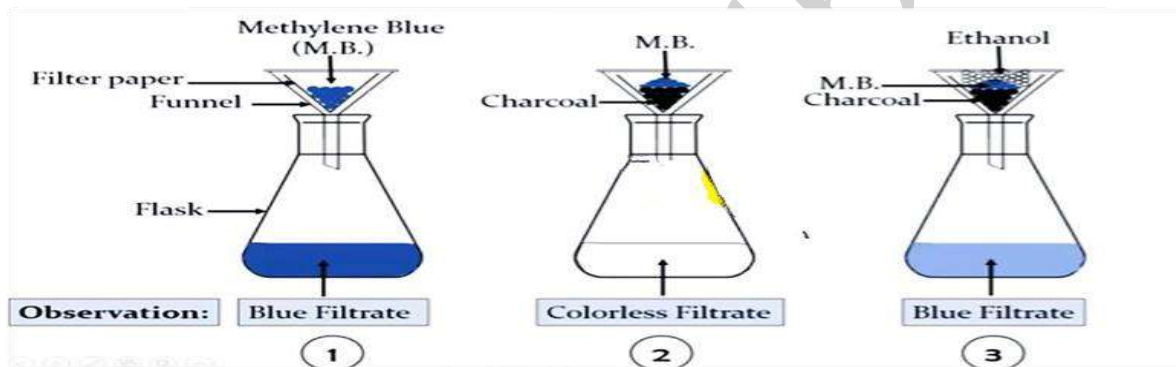


Adsorption

- The ability of colloidal particles to attract & collect other molecules on their surface.
- **adsorbate** → المادة التي تدمص → substance adsorbed on the surface → **M.B**
- **adsorbent** → المادة المدمصة → substance on which it is adsorbed → **Charecol**
- **interface** → The surface where process takes place

➤ Procedure

- 1) Filter methylene blue solution through Filter paper Whatman No. 1 in 1st tube
- 2) Filter another methylene blue solution with activated charcoal through filter paper in 2nd tube.
- 3) Wash filter paper with charcoal from the previous step with **75% ethanol** in 3rd tube.



➤ Observations:

- 1) The filtrate is **blue**.
- 2) The filtrate is **clear**.
- 3) The filtrate is **blue**.

➤ Comment:

- **Adsorption**: The ability of colloidal particles to attract & collect other molecules on their surface.
- The particles of **M.B dye soln** diffuse through filter paper
→ **So the filtrate is blue in 1st tube**
- The **activated charcoal** have power of adsorption of particles of M.B dye on its surface **So** can't pass through F.B while water passes only → **So the filtrate is clear in 2nd**

M.B & charcoal > M.B & H₂O

- By **adding ethanol alcohol** : the attraction between ethanol & M.B **is greater than** between charcoal & M.B dye, so adsorbed particles of MB are released

→ So the filtrate appears blue in 3rd tube

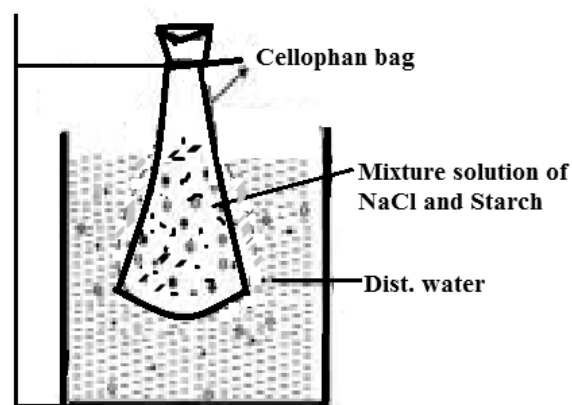
M.B & ethanol > M.B & charcoal



Dialysis

➤ Procedure:

- 1) prepare mixture soln of **starch & NaCl** then half fill a cellophane bag.
- 2) closed bag & hang cellophane bag in beaker containing dist. Water
- 3) Leave apparatus for some times (3-5 hrs)
- 4) test external soln with **iodine & Silver Nitrate** respectively.
- 5) observe the two tests



➤ observation:

- 1) White ppt → in **silver nitrate tube**.
- 2) No blue colour → in **iodine tube**.

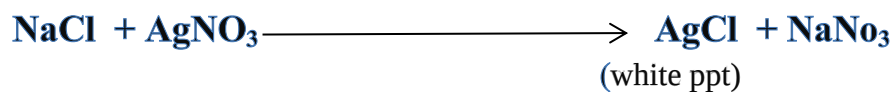
➤ Comment:

- separation of colloidal particles from dissolved ions (crystalloid)

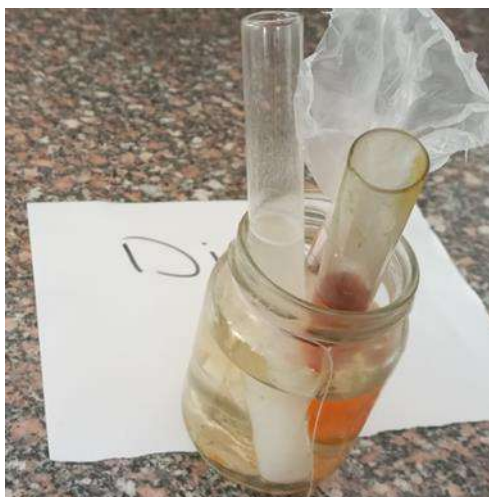
تستخدم هذه الطريقة ف تنقية الغرويات من الشوائب

- **Colloidal particles** **can't** be passed through a **parchment membrane & Cellophane bag**
- **but** ions of electrolyte can pass through it → This property is used in dialysis.

- No **blue colour appears** → This indicates **absence of starch** in H₂O (**starch molecules don't diffuse through cellophane**)
- **AgCl (white ppt)** is produced → presence of Cl⁻ → **NaCl** in water (**Na⁺ & Cl⁻ diffuse through cellophane**) .



- The apparatus used in this method is called **dialyzer**.



Sec 2

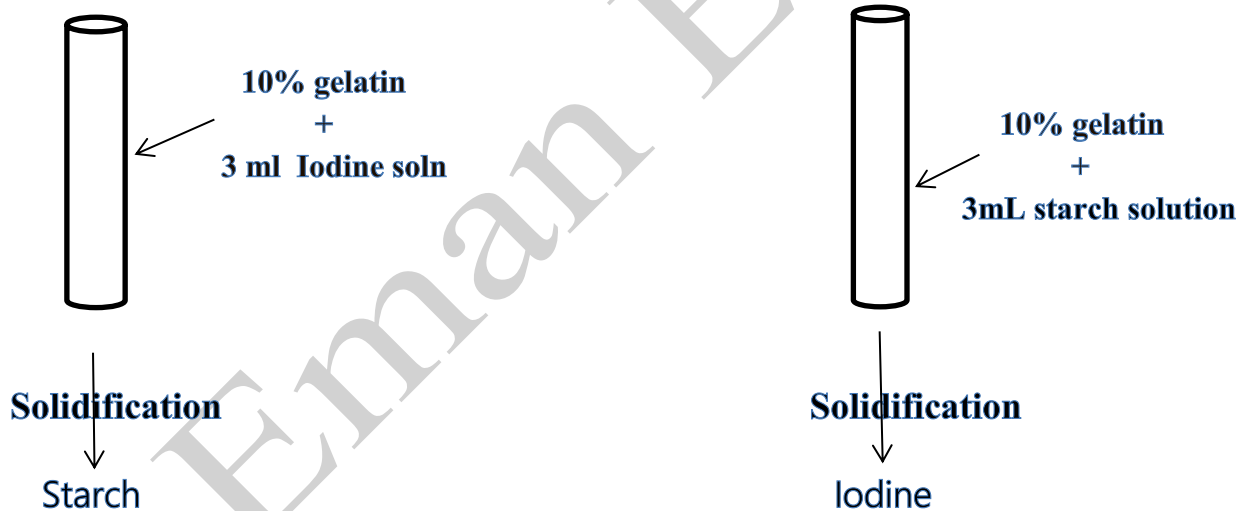
Diffusion

- movement of **molecules or atoms** from a **region of high conc** to **region of low conce** (according to **Size of diffusing particles**)

1) Diffusion of starch and iodine through gel

■ Procedure : (للتوضيح فقط)

- 1) Prepare 10% hot gelatin in two test tubes
- 2) The first test tube add 3mL iodine solution
- 3) The second test tube add 3mL starch solution
- 4) Let the tubes solidify
- 5) Add to the first tube starch solution and to the second one add iodine solution
- 6) Incubate the two tubes over night and observe the two tubes after incubation



■ Observation:

- 1) Colorless tube
- 2) Appearance of blue color at top of gelatin.

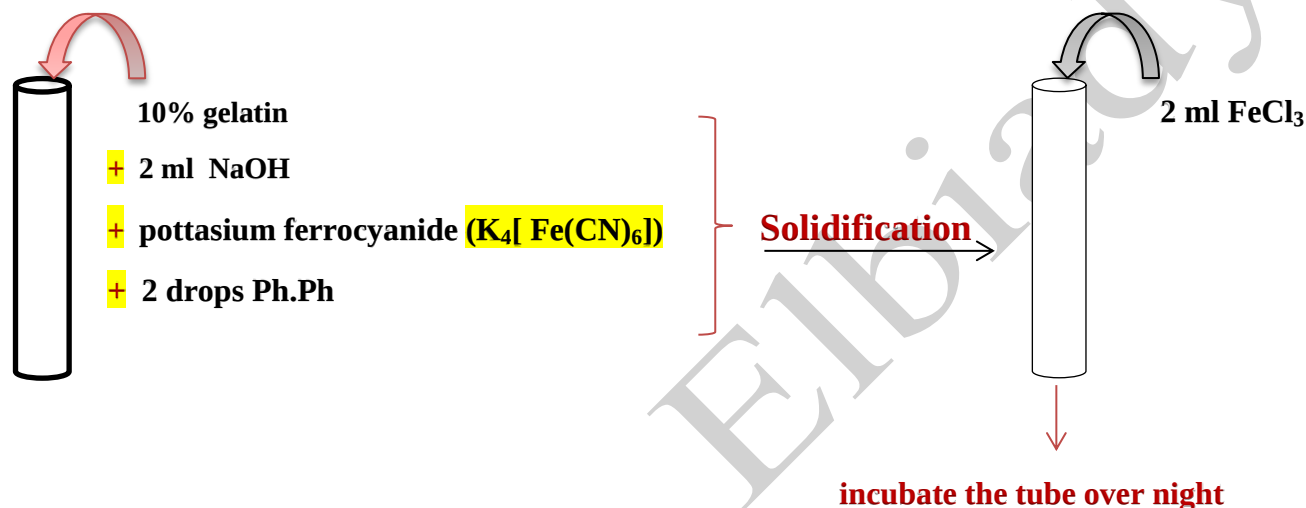
■ Comment:

- **Diffusion** : movement of **molecules or atoms** from **region of high conc** to **region of low conc** → acc to **size of diffusing particles**.
- **Starch (colloid)** → has large particles **so** can't diffuse through gelatin
So no blue colour appears
- **Iodine (crystalloid)** → has small molecules **so** diffuse rapidly through gelatin
So give blue colour with starch

- Rate of Diffusion of ions.

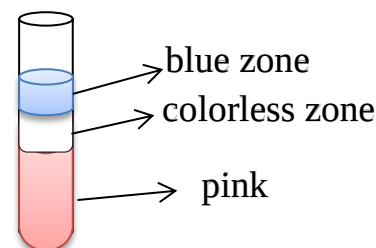
procedures: (للتوضيح فقط)

- 1) prepare 10% hot gelatin in test tubes
- 2) add 2 ml of NaOH , potassium ferrocyanide ($K_4[Fe(CN)_6]$) & drops of ph. Ph (pink)
- 3) let the tube solidify
- 4) add to the tube 2ml of $FeCl_3$ soln
- 5) incubate the tube over night and observe the tube after incubation



Observation:

- a colourless zone followed by a blue zone



Comment :

- **Diffusion** : movement of molecules or atoms from region of high conc to region of low conc → acc to size of diffusing particles.
- $FeCl_3 \longrightarrow Fe^{+3} + Cl^-$
- Both ions can diffuse through gelatin but size of Cl^- smaller than Fe^{+3} So diffuse faster & neutralize of NaOH → forming a colourless zone



- While Fe^{+3} bigger in size so diffuse slower & react with potassium ferrocyanide



→ SO forming blue zone



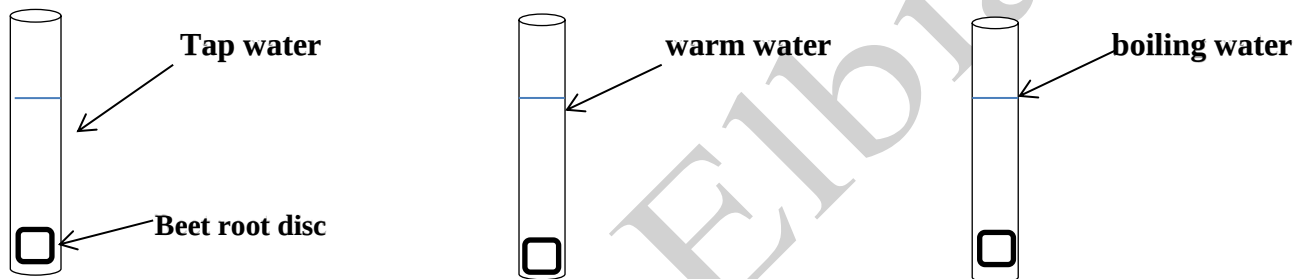
Permeability

- it is a property of membranes that determines capacity to allow pass of molecules through it .
- **cell wall** → permeable
- **plasma membranes** → selectively semi permeable

➤ Effect of temperature on permeability.

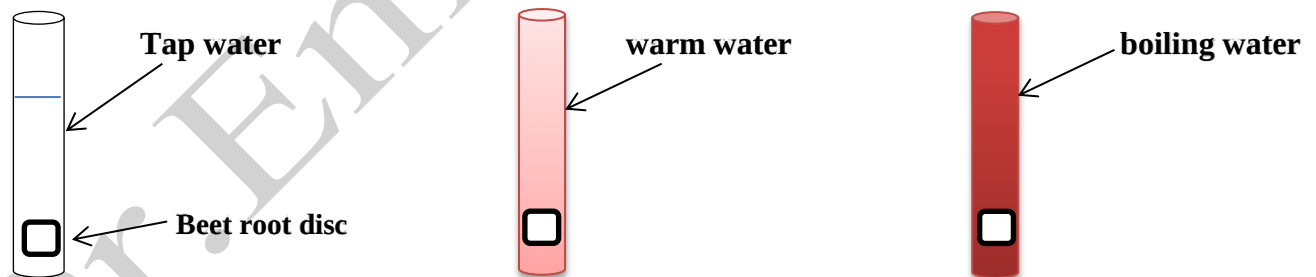
■ Procedures:

1) Cut beet root into thin discs of about 3 mm thick.



➤ Observation:

- 1) Colourless soln. at room temperature
- 2) Light Red soln. at 45°C
- 3) Deep red soln. at boiling



➤ Comment :

- **Permeability** → it is a property of membranes that determines capacity to allow pass of molecules through it .
- Temp affect on permeability
- **At low temp (45°C)** → reversible increase in Permeability
→ thus allowing **slow diffusion of (Anthocyanine)** red colour pigment through P.M
- **At High Temp (> 50°C)** → irreversible increase in Permeability

As it cause denaturation of **p.m** components

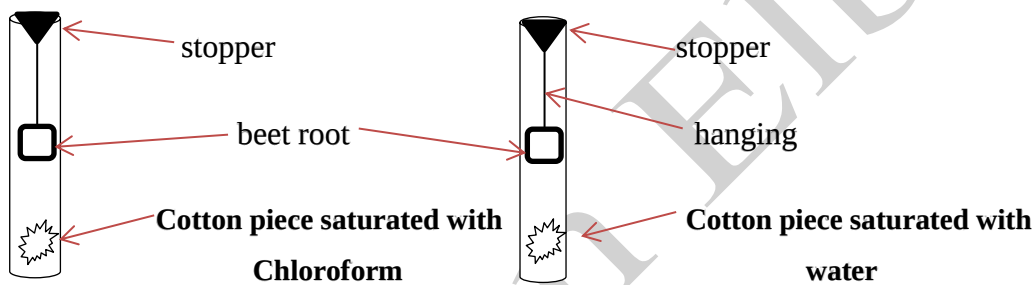
➔ Thus allowing **rapid diffusion of red colour pigments**.



➤ Effect Of Anaesthetics On Permeability.

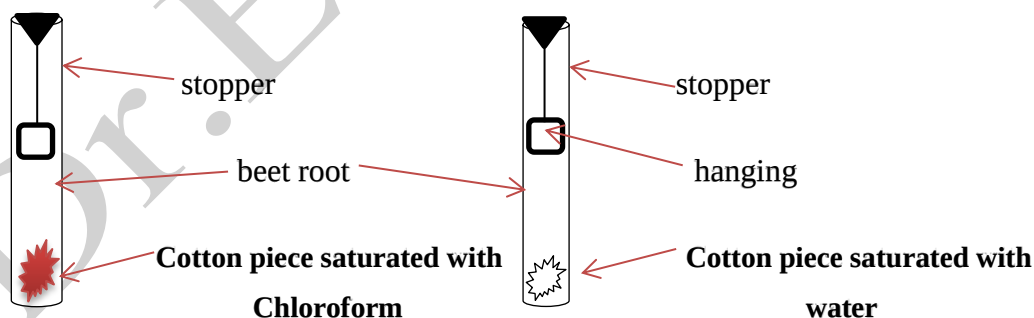
▪ Procedures:

1) Cut beet root into thin discs of about 3 mm thick.



➤ Observation:

- 1) cotton piece with Chloroform at 1st tube → Red colour
- 2) cotton piece with water at 2nd tube → white (no change)



➤ Comment :

- **Permeability** → it is a property of membranes that determines capacity to allow pass of molecules through it .

✓ **At low conc of chloroform** → increase Permeability reversible

✓ **At high conc** → increase Permeability irreversible **due to** dissolution of lipid of plasma membrane.

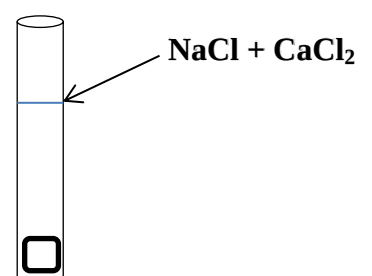
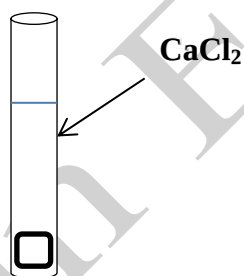
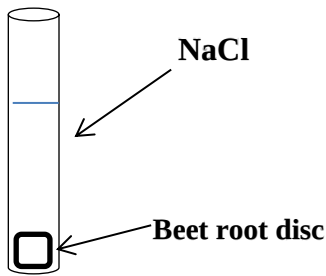
- Chloroform vapors increase permeability **irreversible**

So **Anthocyanine** (red colour pigments) of beet root **out** from cell

➤ Effect Of Antagonism On Permeability

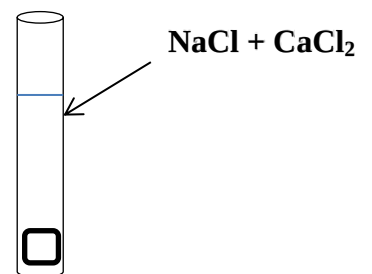
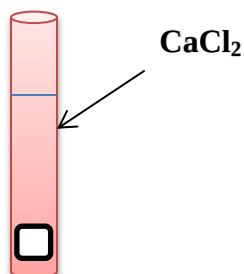
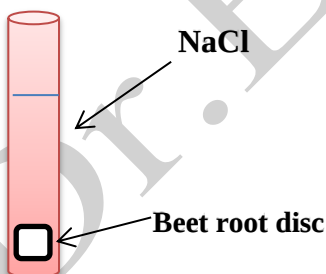
▪ Procedures:

1) Cut beet root into thin discs of about 3 mm thick.



➤ Observation:

- NaCl soln & CaCl₂ soln in 1st & 2nd tubes → **red colour**
- Mixture of NaCl & CaCl₂ soln in 3rd tube → **colourless** .



➤ Comment :

- **Permeability** → it is a property of membranes that determines capacity to allow pass of molecules through it .
 - **Antagonism:** phenomena in which two substance antagonize each other
 - **soln of single salt** of **monovalent** or **divalent** ions (Na^{+1} or Ca^{+2})
increase permeability of **P.M** to (**Anthocyanin**) red colour pigment of beet root → So **1st & 2nd tubes → red colour.**
 - **soln of double salts** of (Ca^{+2} & Na^{+1}) → have **antagonism effect** on each other on permeability → so no change in soln colour.
 - in Salts of **monovalent cations** as **NaCl**
decrease the **binding forces** of plasma membrane components and its **liqification**
 - Salts of **divalent cations** as **CaCl₂**
increase the **binding forces** (over normal state) of P.M components & its **soldfication.**
- by mixing both cations **together** one cation **antagonize** the harmful effect of other

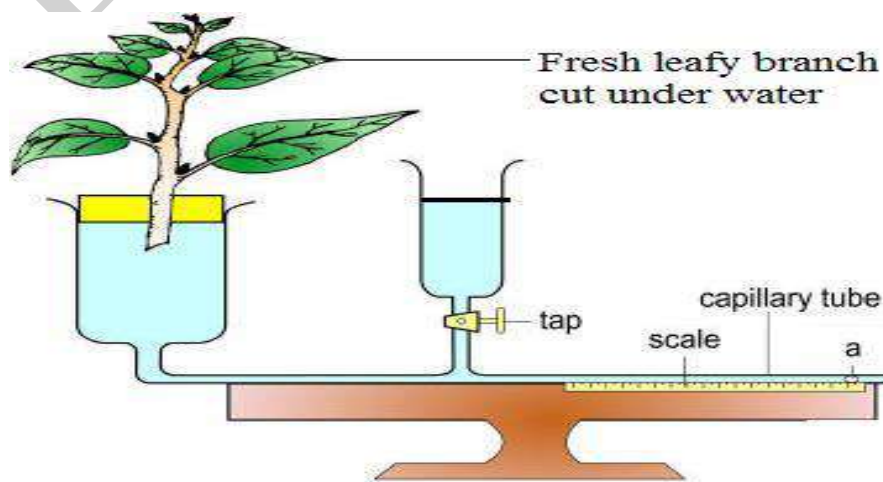
SEC 3

Transpiration

- it is the process of water movement through a plant & its evaporation from aerial parts such as **leaves, stems & flowers**.
 - Water is necessary for plants **but only a small amount of water taken up by the roots** is used for **growth & metabolism**
 - the excess is lost by transpiration.
- Determination of absorption and transpiration rates by potometer.**

✓ Procedure:

- 1) Use a sharp razor blade to cut a leafy shoot under water to avoid air bubbles in water stream.
- 2) Insert the leafy shoot through the hole of the stopper provided with the potometer.
- 3) Fill the potometer with water & fit stopper holding the leafy shoot to apparatus.
- 4) Use vaseline to seal all the connections of the apparatus.
- 5) Weight the apparatus at the beginning of the experiment (W_1) & define the level of water in capillary tube (a).
- 6) Leave apparatus in suitable conditions for **24 hrs**
- 7) Observe the weight of apparatus (W_2) & define the level of water in capillary tube (b).



➤ Observation:

- 1) The weight of apparatus decreases (to W_2).
- 2) The level of water in the capillary tube decreases from **a** to **b**

➤ Comment

- **Transpiration** → the process of water movement through a plant & its evaporation from aerial parts, such as leaves, stems and flowers.
- **Due to** Transpiration, water is lost from leaves & weight of apparatus decreases (to W_2) → **($W_2 < W_1$) Transpiration** .
- Decrease level of water in the capillary tube From (**a** to **b**) → **Absorption**

✓ The rate of Transpiration:

$$\% \text{ of the rate of Transpiration} = \frac{\text{amount of water transpiration} \times 60 \times 100}{\text{Time (min)} \times \text{Transpiration area (cm}^2\text{)}}$$

- Transpiration area (**cm²**) of leaves is **measured by a planimeter**

✓ The rate of Absorption:

- **Weight of water absorbed** = $\Pi r^2 \times L \times d$
 - **d** = water density = $1 \left(\frac{Wt}{\text{volume}} \right)$
 - **L** = distance of water decrease (a - b)
 - **Π** = 3.14
 - **r** = radius of the capillary tube which measured by introducing certain weight of mercury (Hg) to known length
so wt of Hg = $\Pi r^2 \times L \times d$ (of Hg =13.6)

$$\% \text{ of the rate of Absorption} = \frac{(\Pi r^2 \times L \times d) \times 60 \times 100}{\text{Time (min)} \times \text{Transpiration area (cm}^2\text{)}}$$

Osmosis

- Special type of diffusion
- movement of (water) from area of **high conc of water (dilute soln)** → to area of **low conc of water (concentrated soln)** across **semipermeable membrane**.
- movement of (water) from area of **low conc of salt** → to area of **high conc of salt** across **semipermeable membrane**.
- movement of (water) from area of **low osmotic pressure** → to **high osmotic pressure** till equilibrium

1) Osmosis by Thistle Funnel Osmoscope.

• Procedures:

- 1) Close the mouth of Thistle funnel by **parchment** (or **cellophane membrane**)
 - then fill the funnel with **conc. NaCl soln**
- 2) Suspend the funnel in a **beaker** containing **dist. H₂O**
- 3) Leave the apparatus for some time & observe the level of the salt solution inside the funnel during **incubation period**.

• Observation:

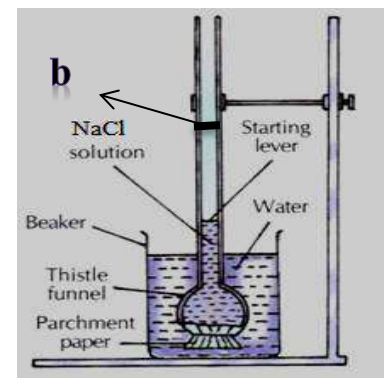
- 1) The level of NaCl soln in funnel rises up. (to point **b**)
- 2) Level of NaCl soln remain at **b**
- 3) After long time the level of the soln will falls down

• Comment

- Osmosis → movement of water from areas of higher conc to areas of lower conc.
- Water move from outside to inside the funnel (endosmosis) due to high osmotic pressure of funnel solution (hypertonic) through pores of bag

So the level of the soln inside the funnel rises up.

- Level of NaCl soln remain at **b**



Due to equilibrium (hydrostatic pressure = osmotic pressure)

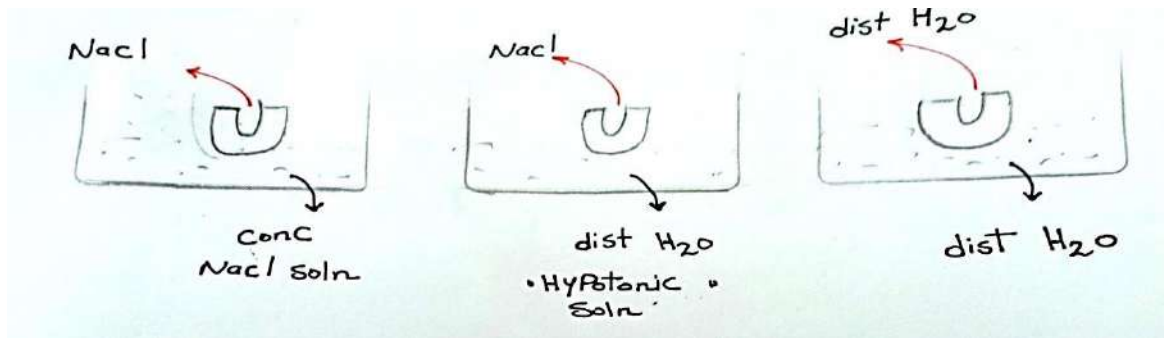
- After long time the level of the soln will falls down

As the cellophane membrane is imperfect semipermeable as pores diameter change → so it allows ions of **NaCl** to diffuse to the external medium.



➤ Potato Osmoscope :

➤ Procedure



✓ Observation:

- **Cube 1:** becomes flaccid & cavity filled with cell sap.
- **Cube 2:** size not change & cavity filled with cell sap.
- **Cube 3:** becomes turgid & the cavity not filled with cell sap

✓ Comment:

- **Osmosis** : movement of (water) from **area of high conc of water** (dilute soln) → to **area of low conc of water** (concentrated soln) across semipermeable membrane
- **In cube 1:** due to **exosmosis** → water **move out** the cube to salt cavity

So cube becomes flaccid & cavity filled with cell sap.

- **In cube 2:**

NaCl crystals will dissolve in diffused cell sap to form a **hypertonic soln** → so water move out cube to salt cavity.

While outer soln is **hypotonic** & so water **move into** the cube **by endosmosis**.

So cube size not changes & cavity filled with cell sap.

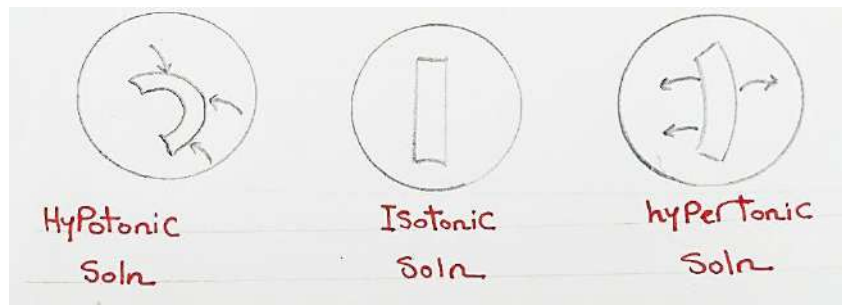
- **In cube 3:** There is **no NaCl soln in cavity** & **outer soln. is hypotonic** (water only)

So water move into cube by **endosmosis**.

So cube becomes turgid & cavity not filled with cell sap.

➤ Osmosis By Tissue Tension.

✓ Procedure:



✓ Observations:

- In hypotonic soln → the curvature of **Ricinus petiole increases**.
- In hypertonic soln → the curvature of **Ricinus petiole decreases**.
- In isotonic soln → the curvature of **Ricinus petiole not changes**.

✓ Comment :

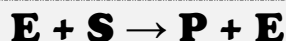
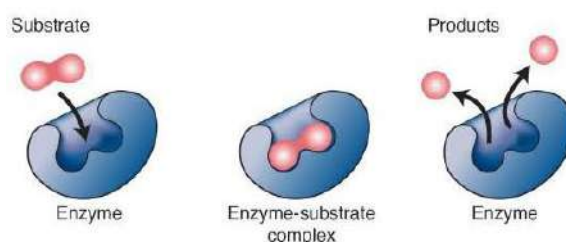
- Osmosis : movement of (water) from area of high conc of water (dilute soln) → to area of low conc of water (concentrated soln) across semipermeable membrane
- In hypotonic soln → diffusion of water into **Ricinus petiole** by **endosmosis** → expansion of parenchyma cells **which** expand & press in cuticle
So curvature increase
- In hypertonic soln → water lost by **exosmosis**
Where O.P of hypertonic soln > suction force of parenchyma cells of pith
So curvature decreases (they become straight or may reversed)
- In isotonic soln → no movement of water.
- Where O.P of soln = the suction force of parenchyma cells of pith
So Curvature not changes.

SEC 4

✓ **Enzymes** → macromolecular **biological catalysts** that **accelerate or catalyze** chemical reactions

OR → Organic protein cpd which **increase** the rate of biochemical reaction

- ✓ The molecules at beginning of reaction called → **substrates**
- ✓ the enzyme converts these into **products**.



→ This means they speed up reactions **without being chemically changed**

✚ **Enzymes Are Classified According To The Reaction Catalyzed Into Several Types**

e.g.

- **Hydrolases** → (catalyze the hydrolysis reactions)
- **Oxidation reduction enzymes** → (catalyze oxidation reduction reactions)

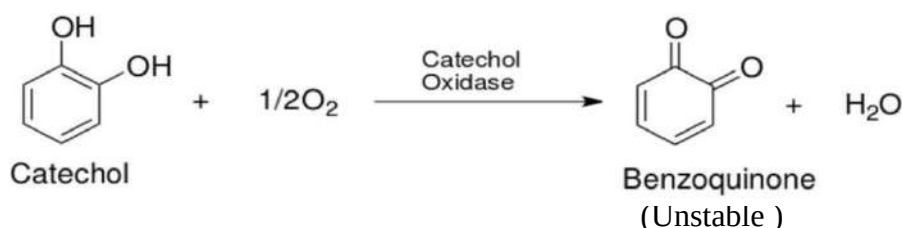
✚ **Note :**

(1) **عملية الأكسدة** هي عبارة عن إضافة أكسجين أو فقد الكترون (هيدروجين)

(2) **عملية الاختزال** هي عملية اكتساب الكترون (هيدروجين) وفقد اكسجين

Oxidase Enzyme

- **Chatechol oxidase enzyme** → is **oxidation reduction enzyme** that **catalyze** the **oxidation** of **phenolic compounds** (catechol) to → **corresponding quinone** by using atmospheric oxygen as hydrogen acceptor.



✚ **Note :** quinine compound is **unstable** so it **polymerized** into **melanine pigments** of **brown colour**.

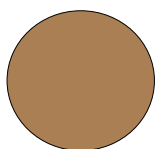
➤ Objectives:

- Observation activity of **oxidase enzyme** in **potato tuber**.

➤ procedures:

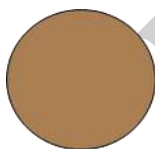
- 1) Peel قشر potato tuber & cut into 3 pieces
- 2) Leave the first piece without any change
 - add **Pyrogallol** to the second
 - add **Guaiacum** (alcoholic soln) to the third
 - and leave **3 pieces** in air.
- 3) Observe the color of **3 pieces**.

➤ Observation



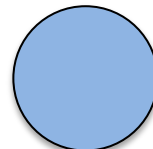
Potato disc **without any addition**

Turns to brown



potato disc with **Pyrogallol**

Turns To Brown



potato disc with **Guaiacum**

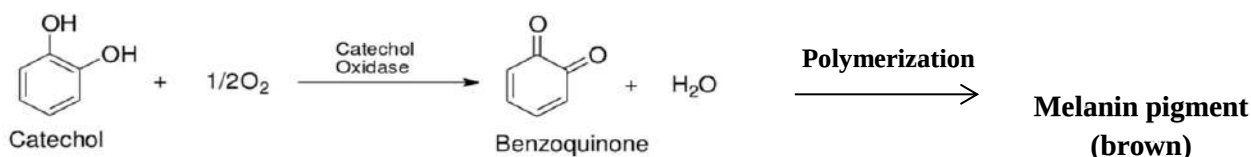
Turns To Blue

➤ Comment

- **Enzyme** → Organic protein cpd which **increase** the rate of biochemical reaction
- **Oxidase enzyme** → catalyze the oxidation of substrate (phenolic cpd)
By removing hydrogen from them & use activated atmospheric O_2 as hydrogen acceptor to form water
- Potato contain both **Oxidase enzyme & phenolic cpd**

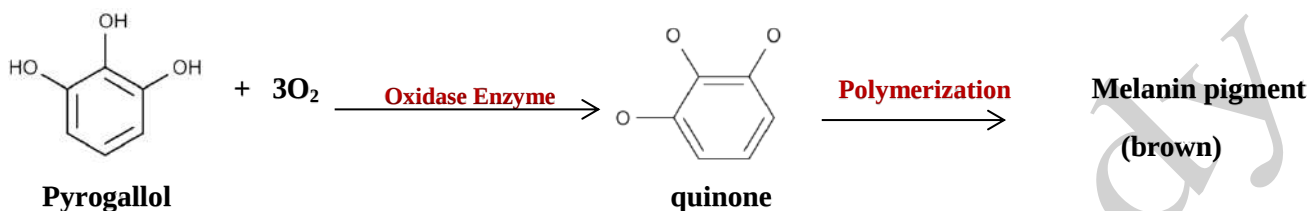
➤ Procedure 1 :

- Oxidase enzyme catalyze the oxidation of substrate (phenolic cpd) by **using oxygen of air**
- Potato disc contain **oxidase enzyme** Which catalyze **the oxidation** of **phenolic cpd** which convert into **corresponding Quinones** which **polymerize** into **brown melanin pigments**



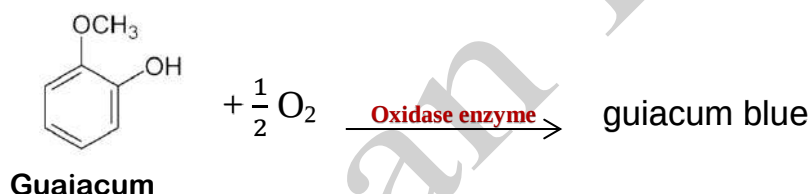
➤ Procedure 2 :

- Oxidase enzyme catalyze the oxidation of substrate (phenolic cpd) by **using oxygen of air**
- Potato disc contain **oxidase enzyme** Which catalyze **the oxidation** of **Pyrogallol** (phenolic cpd) which convert into **corresponding Quinones** which **polymerize** into **brown melanin pigments**



➤ Procedure 3 :

- Potato disc contain **oxidase enzyme** Which catalyze **the oxidation** of **Guaiacum** (phenolic cpd) into guaiacum blue



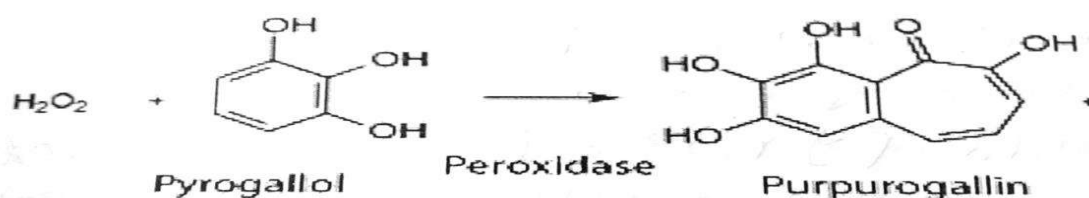
✚ Note :

- When a **peeled potato tuber or eggplant or apple** fully immersed in water & exposed to air → its colour not changed **due to** absence of atmospheric oxygen → which used by oxidase as hydrogen acceptor → **So** oxidase enzyme doesn't act on **oxidation process**



Peroxidase Enzyme

- **Peroxidase enzyme** → is **oxidation reduction enzyme** which catalyzes the oxidation of **phenolic compounds (Pyrogallol)** to corresponding **quinine** using **atomic oxygen** from **hydrogen peroxide (H_2O_2)** as hydrogen acceptor. → (Oxygen from H_2O_2)



➤ Objectives:

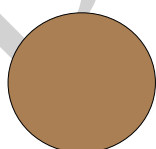
- Observation activity of **Peroxidase enzyme** in **radish tuber** الفجل/ turnip اللفت

➤ Procedures:

- 1) Peel radish tuber and cut into 3 pieces
- 2) Leave the first piece without any change
 - add **Pyrogallol** to the second
 - add **Guaiacum** (alcoholic soln) to the third
 - and leave **3 pieces** in air.
- 3) Observe the color of **3 pieces**.
- 4) Add hydrogen peroxide (H_2O_2) & Observe the color of **pieces**.



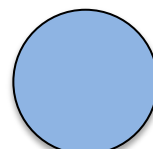
➤ Observation



Radish disc without any addition
Turns to brown



Radish disc with **Pyrogallol**
Turns To Brown

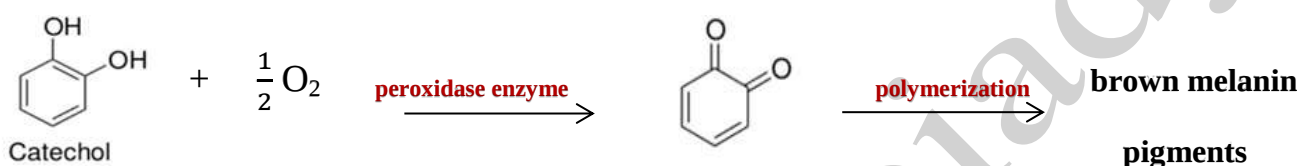


Radish disc with **Guaiacum**
Turns To Blue

➤ Comment

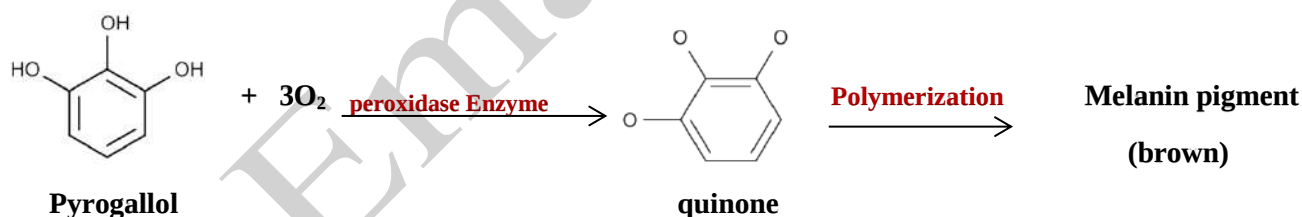
✓ Procedure 1:

- **Peroxidase enzyme** catalyzes the oxidation of **substrate** by using **atomic oxygen** from (H_2O_2) as **hydrogen acceptor**.
- Turnip or raddish disc contain peroxidase enzyme which catalyze oxidation of phenolic compounds (**catechol**) by using oxygen from H_2O_2
- phenolic compounds are oxidized and convert into **corresponding Quinones** which **polymerize** into **brown melanin pigments**



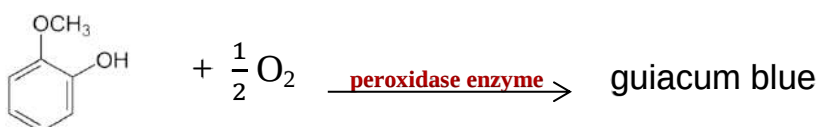
✓ Procedure 2:

- **Peroxidase enzyme** catalyzes the oxidation of **substrate** by using **atomic oxygen** from (H_2O_2) as **hydrogen acceptor**.
- Turnip or raddish disc contain peroxidase enzyme which catalyze oxidation of phenolic compounds (**Pyrogallol**) by using oxygen from H_2O_2
- phenolic compounds are oxidized and convert into **corresponding Quinones** which **polymerize** into **brown melanin pigments**



✓ Procedure 3 :

- **Peroxidase enzyme** catalyzes the oxidation of **substrate** by using **atomic oxygen** from (H_2O_2) as **hydrogen acceptor**.
- Turnip or raddish disc contain peroxidase enzyme which catalyze oxidation of phenolic compounds (**Guaiacum**) by using oxygen from H_2O_2
- phenolic compounds are oxidized & convert into **guaiacum** which **blue in colour**



Schardinger's Enzyme

- **Schardinger's enzyme** → is **dehydrogenase enzyme** which catalyzes oxidation reduction reactions using any substance rather than **atmospheric oxygen** as hydrogen acceptor **but in presence of atmospheric oxygen prefers it as hydrogen acceptor**.
- Schardinger's enzyme present in **milk**

➤ Objectives:

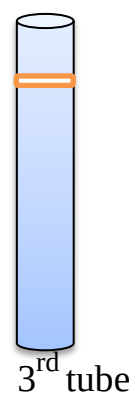
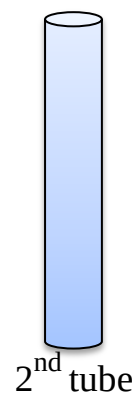
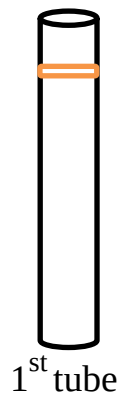
- Observation activity of Schardinger's enzyme in milk

➤ Procedures:

- 1) Prepare 3 test tube
- 2) **The first tube** contains **10 ml fresh milk, formaldehyde & methylene blue** and cover surface with **paraffin oil**.
- 3) **The second tube** contains **10 ml fresh milk, formaldehyde and methylene blue** and leave surface open to air.
- 4) **The third tube** contains **10 ml boiled milk, formaldehyde and methylene blue** and cover the surface with **paraffin oil**.
- 5) Incubate 3 tubes in water bath at 40 °C for **half an hour**.
- 6) Observe the color of 3 test tubes **after incubation**.

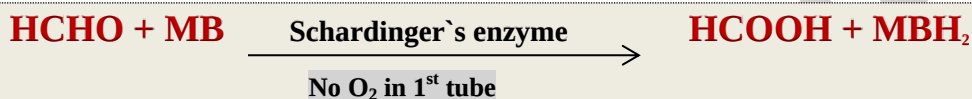
➤ Observation:

- 1st tube White milky colour
- 2nd tube Blue colour
- 3rd tube Blue colour

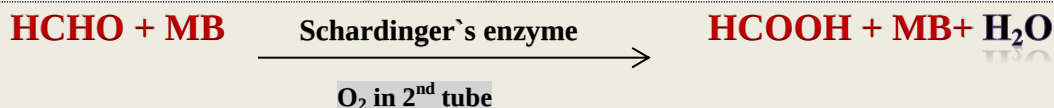


➤ Comment:

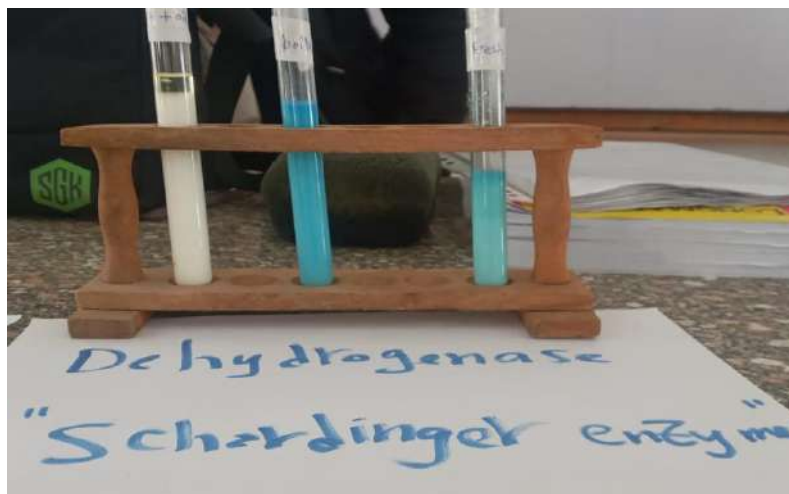
- Schardinger's enzyme is dehydrogenase enzyme which catalyzes oxidation reduction reactions using any substance rather than atmospheric oxygen as hydrogen acceptor but in the presence of atmospheric oxygen prefers it as hydrogen acceptor.
 - Schardinger's enzyme present in milk
 - ✓ in the 1st tube (in absence of atmospheric oxygen)
 - Schardinger's enzyme oxidizes **formaldehyde** → into **formic acid** &
 - reduces **methylene blue** → to **leucomethylene blue** (**colorless**)
- So the blue colour of methylene blue will gradually disappear.



- ✓ in case of 2nd tube (in the presence of atmospheric oxygen)
 - **Schardinger's enzyme** prefers it as **hydrogen acceptor instead** of **methylene blue**
- So the blue colour of methylene blue won't disappear.



- ✓ in case of 3rd tube (**using boiled milk**)
- the blue colour of methylene blue **will not** disappear **As** boiling destroys the enzyme activity due to **its protenic nature**.



SEC 5

Respiration

- **In respiration** → plants & animals convert **sugars** (from photosynthesis) → back into **Energy** for **growth & other life processes**.
- Chemical Equation For Respiration :

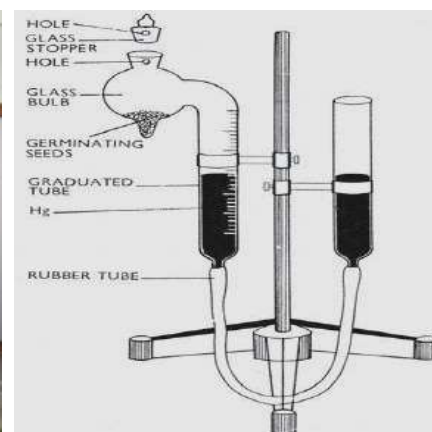
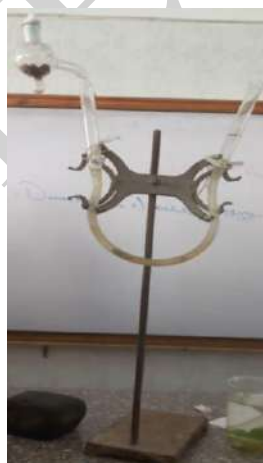
Enzymes/Cytosol & Mitochondria



➤ Determination of Respiratory Quotient during respiration :

• **Observation:**

- The level of **NaCl** soln in graduated tube (**according to seed type**) may be:
 - 1) Not change in case of carbohydrates.
 - 2) Rises up in case of Lipids.
 - 3) Fall down in case of organic acids.



• **Comment**

- Respiratory quotient : the ratio of volume of CO_2 produced to volume of O_2 consumed
- It can be **1, zero, (> or < 1)**

$$\text{RQ} = \frac{\text{Volume of } \text{CO}_2 \text{ evolve}}{\text{Volume of } \text{O}_2 \text{ absorbed}}$$

➤ level of **NaCl** soln in graduated tube → **not changed**

- If carbohydrates are **substrate** & **aerobic respiration**



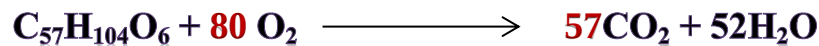
$$\text{RQ} = \frac{6\text{CO}_2}{6\text{O}_2} = 1$$

- the volume of **CO_2 output** equal to volume of **O_2 consumed** → So **RQ = 1 (unity)**

➤ level of NaCl soln in graduated tube → **rises up**

- If respiratory substrate is (lipids or protein) & aerobic
- RQ is about **0.7** for most of **common fats**.

It occurs during germination of fatty seeds. (**triolein**) (حمض الأوليك) تريولين

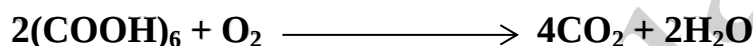


$$\text{RQ} = \frac{57\text{CO}_2}{80 \text{ O}_2} = 0.71 \text{ triolein}$$

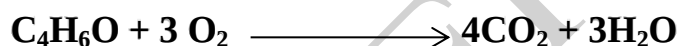
- the volume of **CO₂ output** less than volume of **O₂ consumed** → So (RQ < 1)

➤ the level of NaCl soln in graduated tube → **falls down**

- If respiratory substrate are organic acids & aerobic condition



$$\text{RQ} = \frac{4\text{CO}_2}{\text{O}_2} = 4 \text{ oxalic acid}$$



$$\text{RQ} = \frac{4\text{CO}_2}{3 \text{ O}_2} = 1.3 \text{ malic acid}$$

- The Volume Of **CO₂ Output** more than Volume Of **O₂ Consumed** → SO (RQ > 1)

➤ NOTE

- R.Q in **Anaerobic Respiration** → ∞ → AS During anaerobic respiration, **CO₂ is released** but **O₂ not consumed**.
- R.Q= **Zero** → when respiratory substrate is **incompletely oxidized**

لأنه سيكون وصل لحمض دهني معين ومتكونش CO₂

Photosynthesis

- process used by plants & other organisms to convert **light energy** → into **chemical energy**

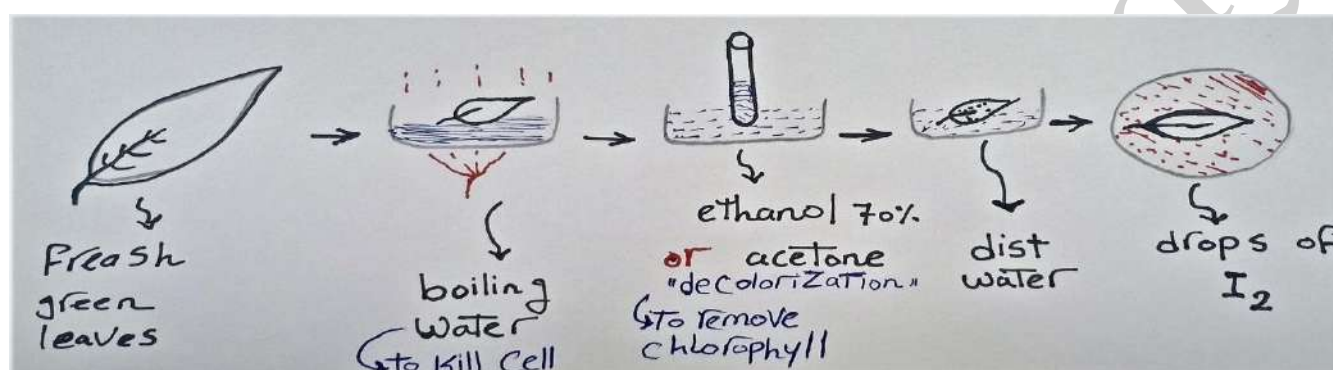
Or → the formation of **complex organic cpds** from **simple inorganic cpds** in presence of **light energy & chlorophyll**

light energy+ Chlorophyll



➤ **Ex : Formation Of starch during photosynthesis:**

✓ **Procedure :**



✓ **Observation:**

- leaf color turns into dark blue color

✓ **Comment :**

- Photosynthesis :formation of complex organic cpds from simple inorganic cpds in presence of light energy & chlorophyll

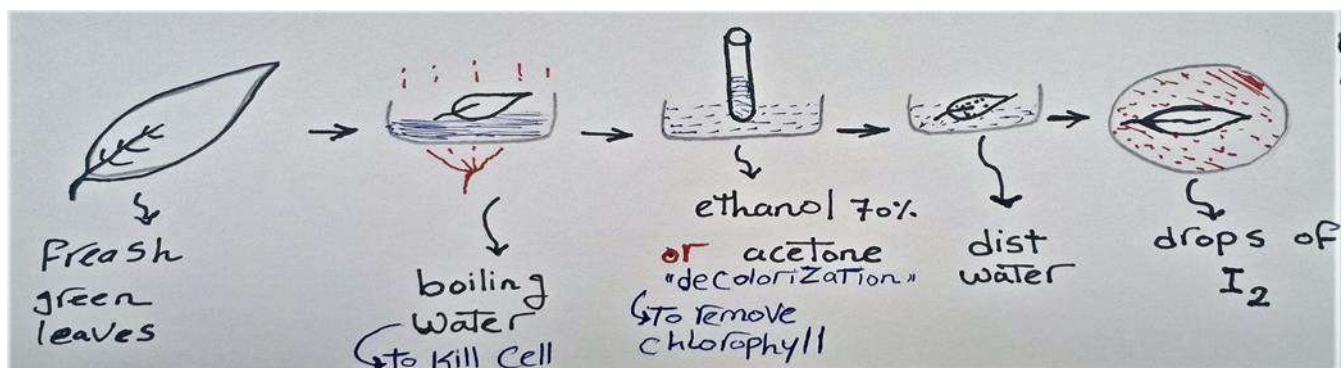
light energy+ Chlorophyll



- dark blue color indicates presence of starch as end product of photosynthesis in green leaves.

➤ Ex: Importance of chlorophyll during photosynthesis:

✓ Procedure :

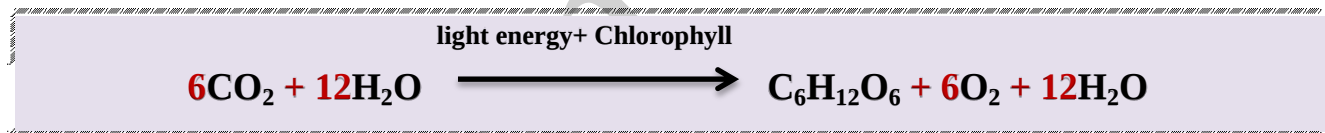


✓ Observation:

- A blue black colour develops in green parts only while white parts takes iodine colour

✓ Comment:

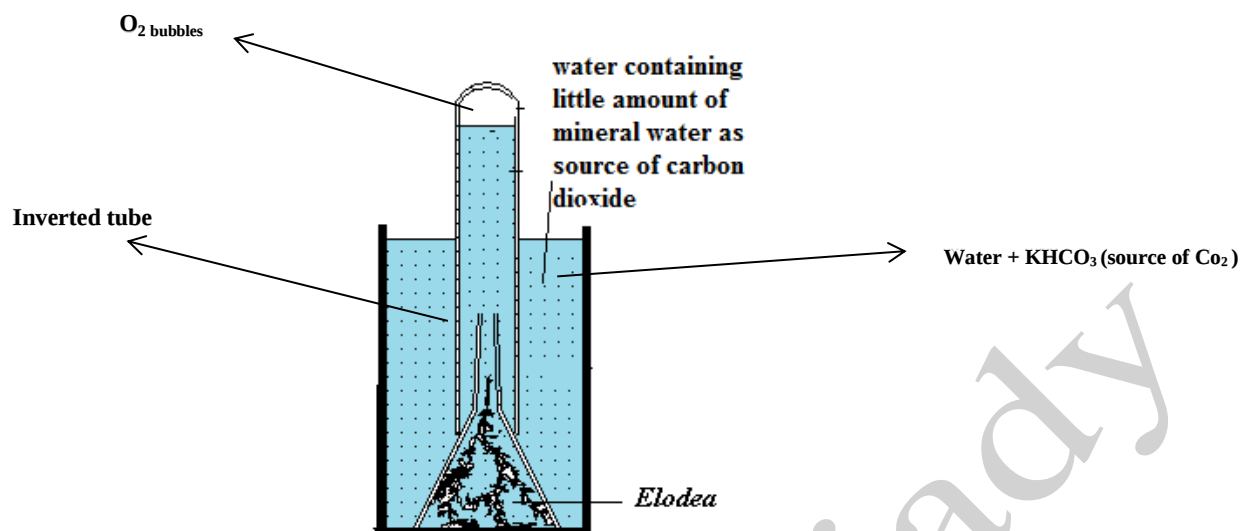
- **Photosynthesis** :formation of complex organic cpds from simple inorganic cpds in presence of light energy & chlorophyll



- The **white parts** contain **no pigment** (no starch) **While green parts** contain **chlorophyll**
- **So blue black colour** develops in **green area only** → indicates the presence of starch (photosynthesis)
- **While white parts** takes **iodine colour** **As** contain no pigment



✓ Evolution Of Oxygen During Photosynthesis:

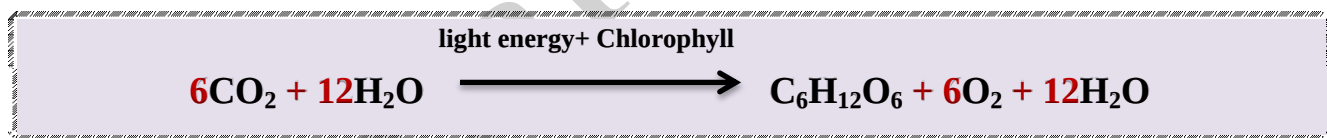


➤ Observation

- 1) A small O₂ bubbles are liberated from cut ends of plant to top of test tube.
- 2) collection of O₂ gas will glow splinter

➤ Comment :

- **Photosynthesis** :formation of complex organic cpds from simple inorganic cpds in presence of light energy & chlorophyll



- Glowing splinter → indicate that **O₂ gas** is **evolved** during photosynthesis if all factors that necessary for it **are available**.

