

# **GRADE 11 SCIENCE NATIONAL SYLLABUS 1<sup>ST</sup> TERM REVISION SEMINAR**

**Organized by:  
Muslim Majlis Society,  
University of Sri Jayewardenepura**

## Webinar Hosted By:-

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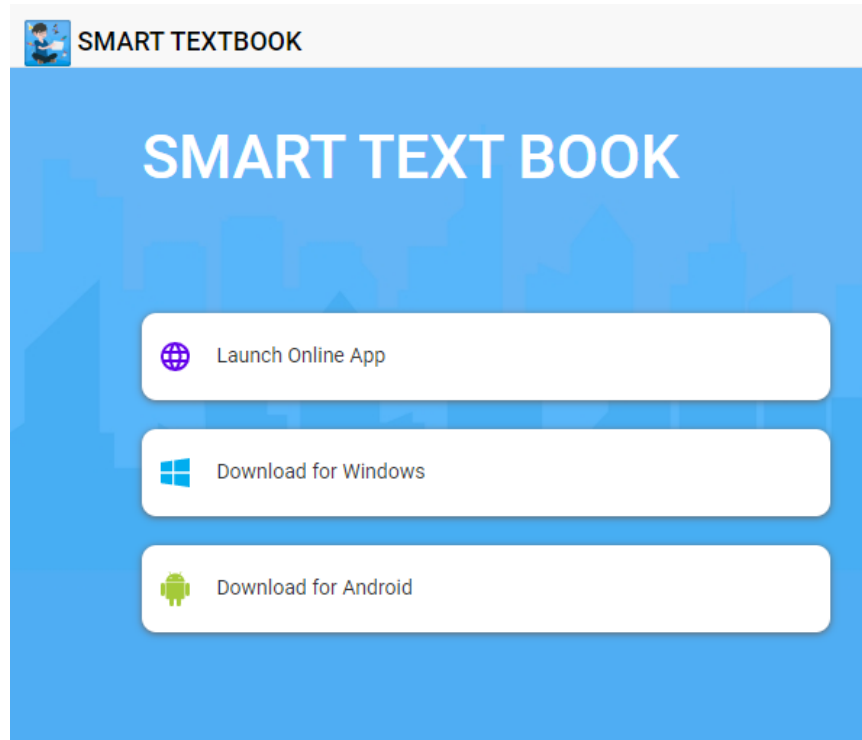


## *INSTRUCTIONS TO STUDENTS:-*

- You may ask your doubts (if any) LIVE, related to the question being discussed, using the ? icon.
- You are free to jot down any extra points during discussion.
- The objective of this webinar is to provide a quick re-cap of 1<sup>st</sup> term lessons Unit 01-04 through questions discussion. A separate webinar will be done on Unit 05.
- The question paper has been e-mailed to you.

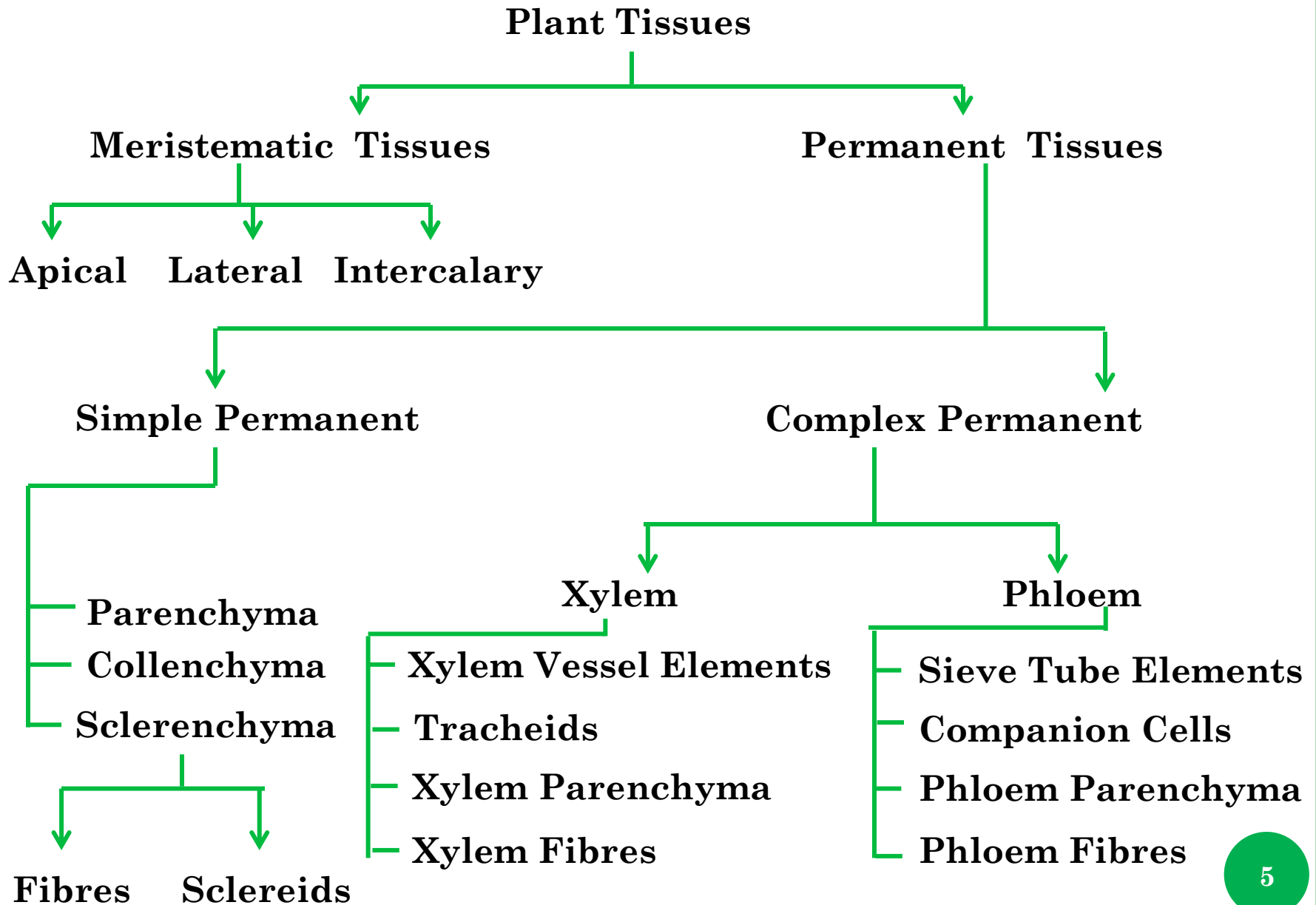
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In case you didn't know.....

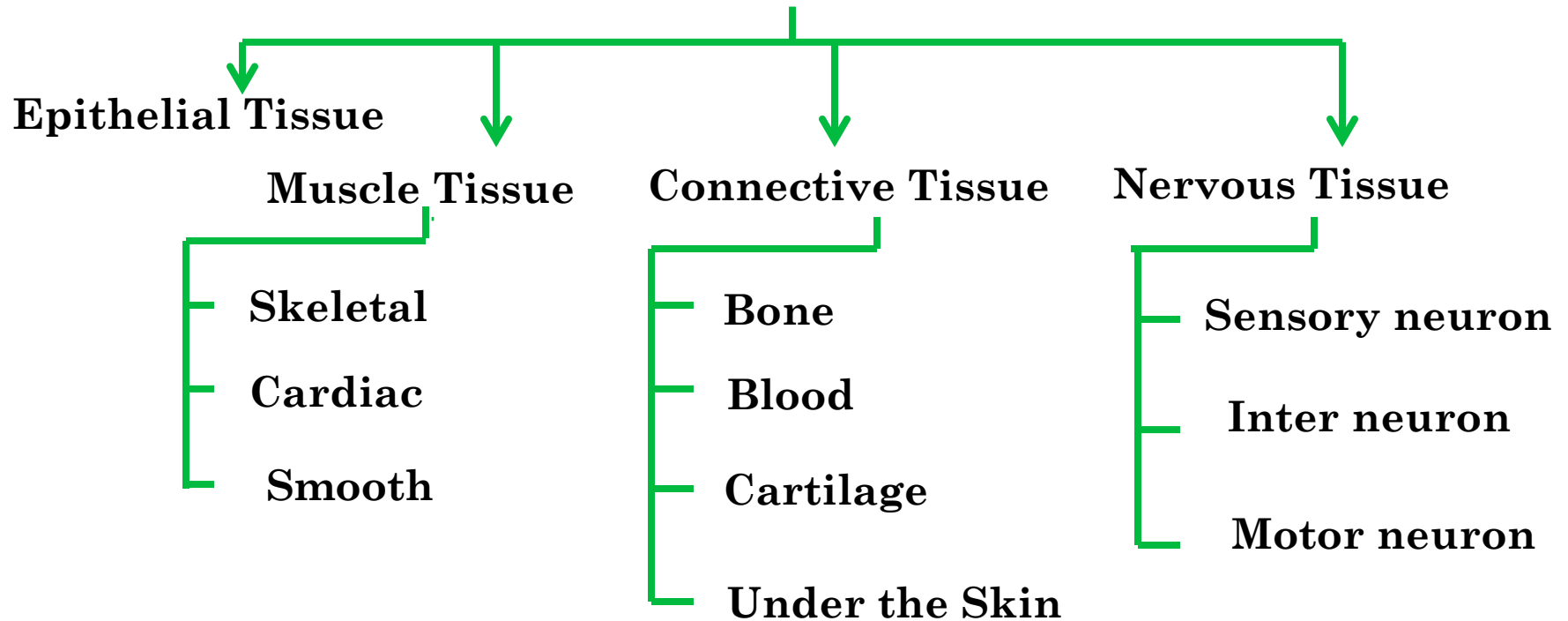


**By Ministry of Education-  
For Grade 11 Students: Science Summary Videos & Science Quizzes**

**Google “Grade 11 Smart Textbook”  
Or go to <http://smarttextbook.epd.gov.lk/>**



# Animal Tissues



# QUESTION 01

a) What is the type of tissue that is responsible for the growth of plants?

Meristematic Tissues

b) What is meant by differentiation of cells?

The process of cells becoming modified and specialized to carry out a specific function (s).

# QUESTION 01

c) Why do meristematic tissues have large numbers of mitochondria?

They are rapidly dividing to produce new cells by the process of mitosis which is an “*active process*” (requires ATP/ energy)

d) State the name of the most abundant tissue in plants.

Parenchyma tissue



# QUESTION 01

e) i) What is the basic function of 'dead tissues' in plants (other than transportation of water)?

Providing mechanical support and strength

e) ii) Give names of 2 'partially dead' tissues in animals.

There are no specific completely dead tissues in animals unlike in plants!

However, **hair and nails** are e.g. of partially dead tissues. (The roots of them are living)

Also, dead tissues are found near "wounds" *temporarily*.

NOTE:- Even the Bone Tissues are living tissues!

# QUESTION 01

e) iii) List out the names of the dead tissues of plants.

- Sclerenchyma
- Xylem Vessel Elements
- Tracheids
- Xylem Fibres
- Phloem Fibres

## QUESTION 01

e) iv) State 2 compounds present in the cell wall of dead plant tissues.

- Cellulose
- Lignin

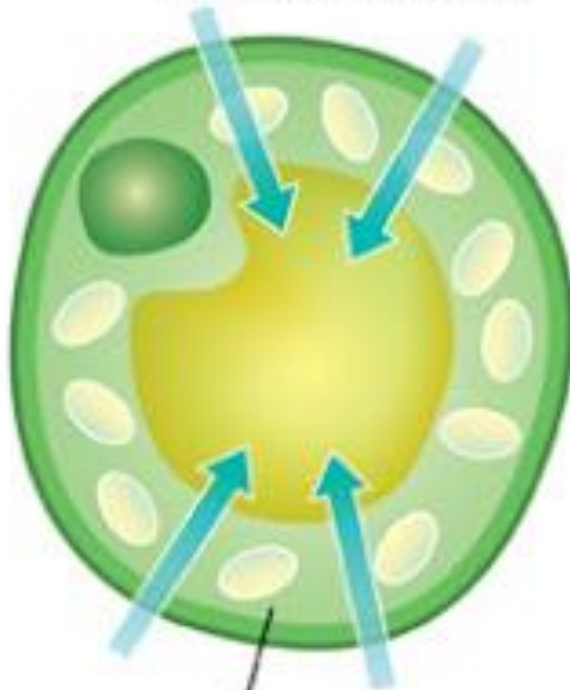
f) How do parenchyma tissues provide a mechanical support for herbaceous plants?

Herbaceous plants like *Balsam* absorb water into vacuoles of the parenchyma cells.

Thereby cells become **turgid** and provide mechanical support to the plant.

## Turgid Cell

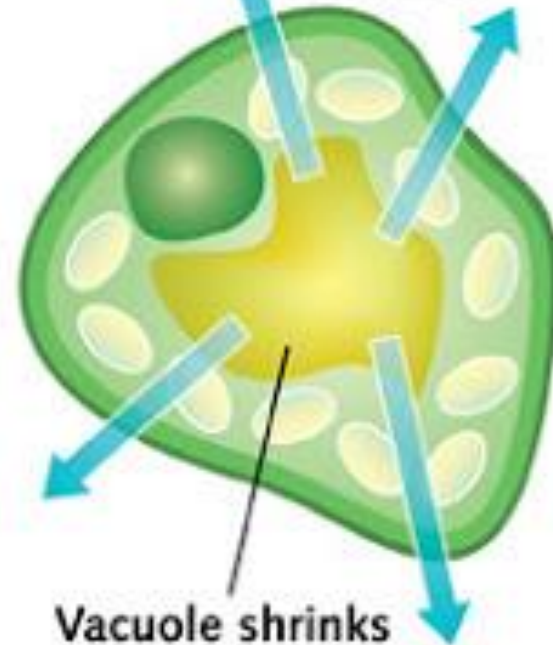
Water enters cell



Vacuole swells and pushes against cell wall

## Flaccid Cell

Water lost from cell



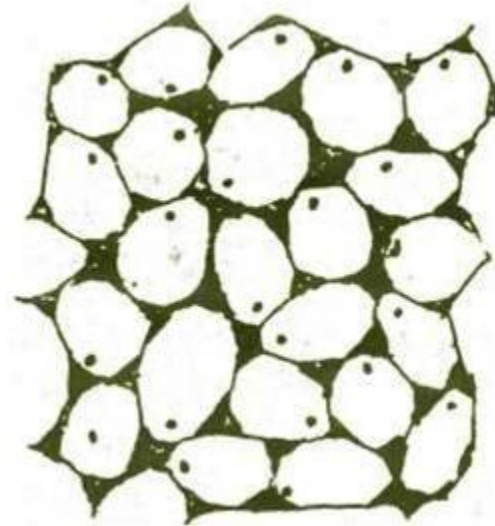
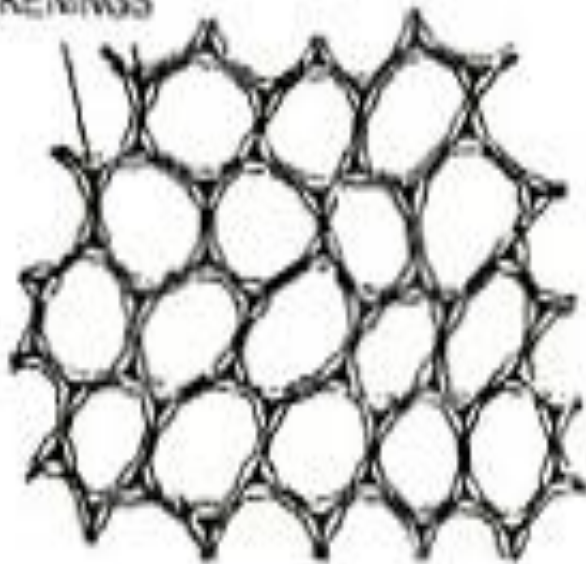
Vacuole shrinks and cell loses shape

## QUESTION 01

g) State a unique feature of collenchyma that helps to identify it.

**Corners of cell wall are thickened (with cellulose)**

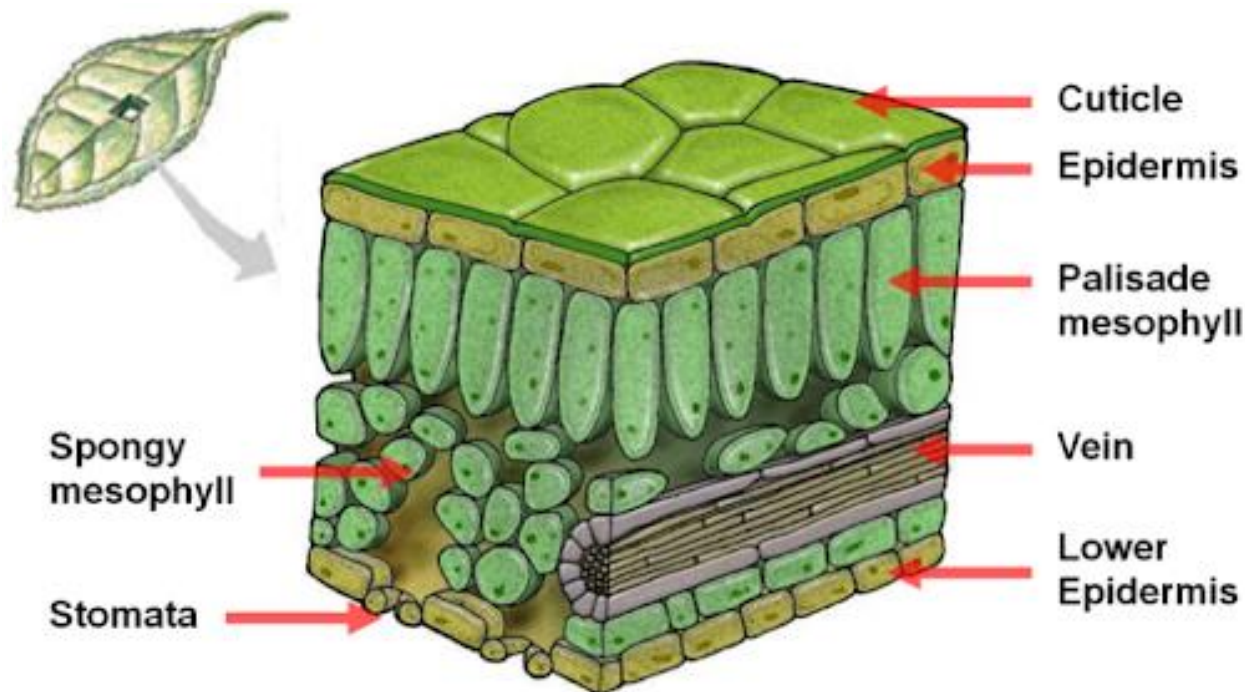
ANGULAR  
THICKENINGS



## QUESTION 01

h) State the name of 2 major tissues present in leaves that contain chlorophyll.

Pallisade mesophyll, Spongy mesophyll  
(parenchyma)



# QUESTION 01

i) Why are intercellular spaces prominent in a parenchyma tissue?

Because the cells in parenchyma tissue are isodiametric in cross section (not polygonal) / spherical

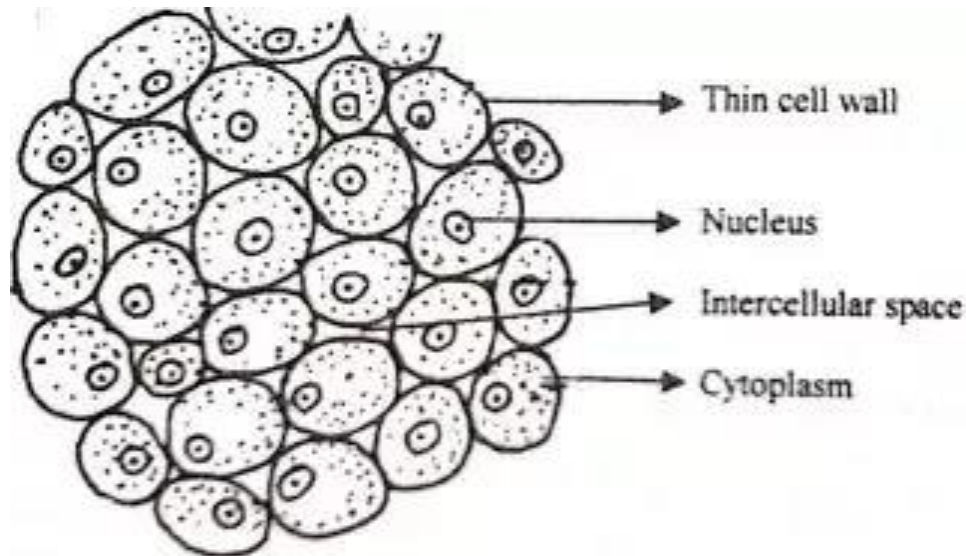


Fig: A typical parenchyma tissue

# QUESTION 01

j) i) State the tissues that are involved in transportation of water & minerals in plants.

- Xylem Vessel Elements

- Tracheids

of xylem tissue

j) ii) State the name of a tissue that is involved in translocation in plants.

- Sieve tube elements

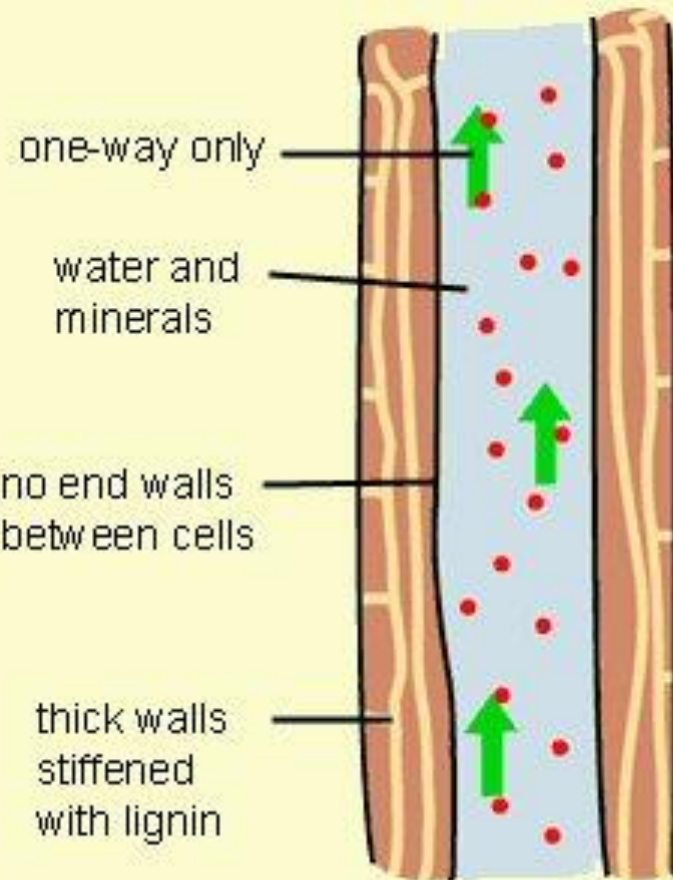
of phloem tissue



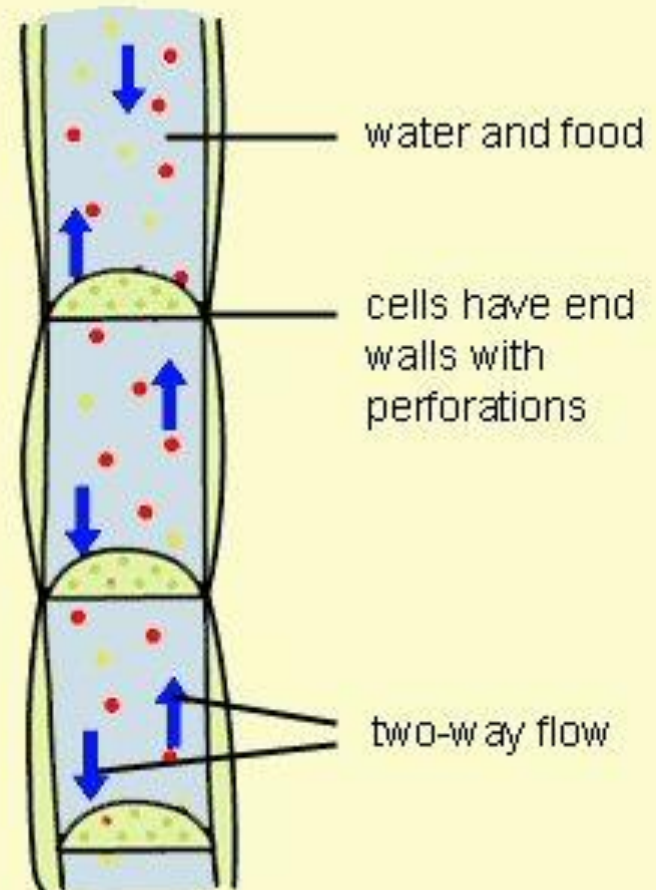
# QUESTION 01

j) iii) State the adaptations present in the tissues mentioned above for efficient transportation?

- The cross walls are dissolved to form a continuous tubular xylem vessel element.
- The xylem vessels are dead, rigid with lignin deposition.
- The cross walls are incompletely dissolved to form a sieve tube. (sieve plate)
- Sieve tube elements lack a nucleus, associated with companion cells.



**xylem vessel**

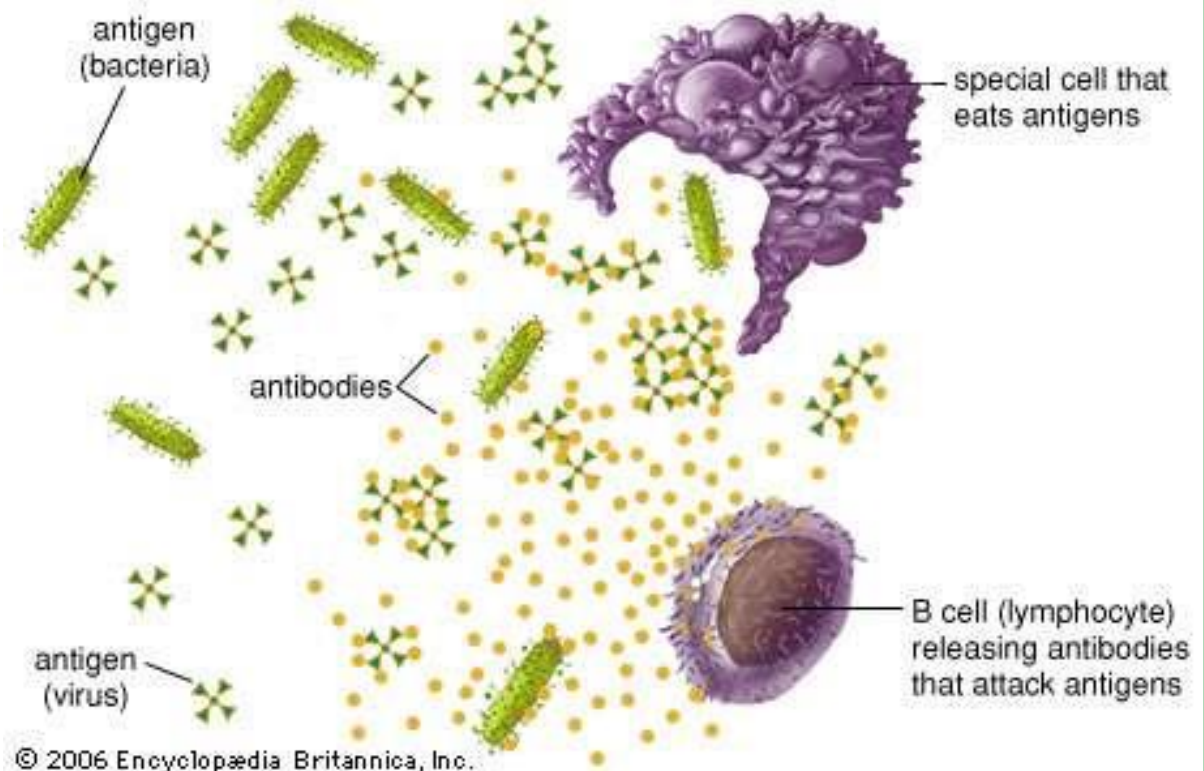


**phloem vessel**

# QUESTION 01

k) State the 2 basic ways by which white blood cells provide immunity and helps in protection from pathogens?

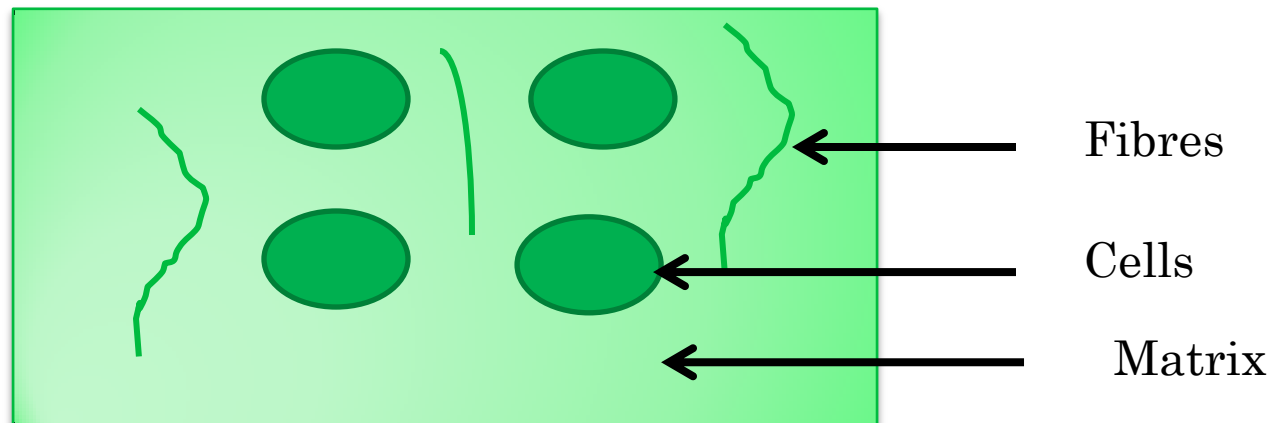
- by phagocytosis
- by producing antibodies.



# QUESTION 01

1) Why is blood considered a 'special' connective tissue?

- The matrix (blood plasma) is not secreted by the blood cells.
- The matrix is liquid.
- Fibres are not found always but only during blood clotting they appear.

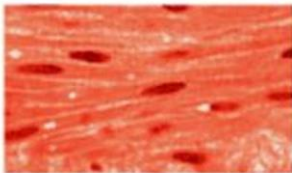


# QUESTION 01

m) State the type of muscle tissue that is voluntarily controlled.

**Skeletal muscle**

SMOOTH MUSCLE



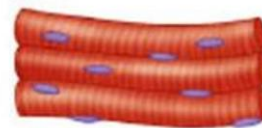
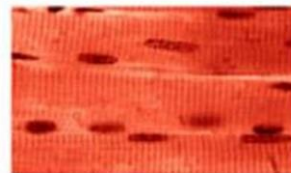
INTERNAL ORGANS

CARDIAC MUSCLE



HEART

SKELETAL MUSCLE



LEG

involuntary

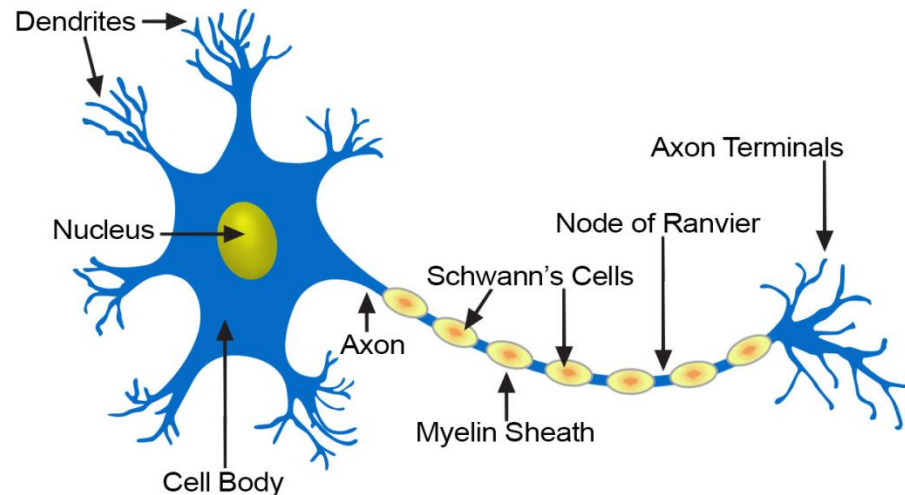
voluntary

# QUESTION 01

n) What is the advantage of myelination of axons of neurons?

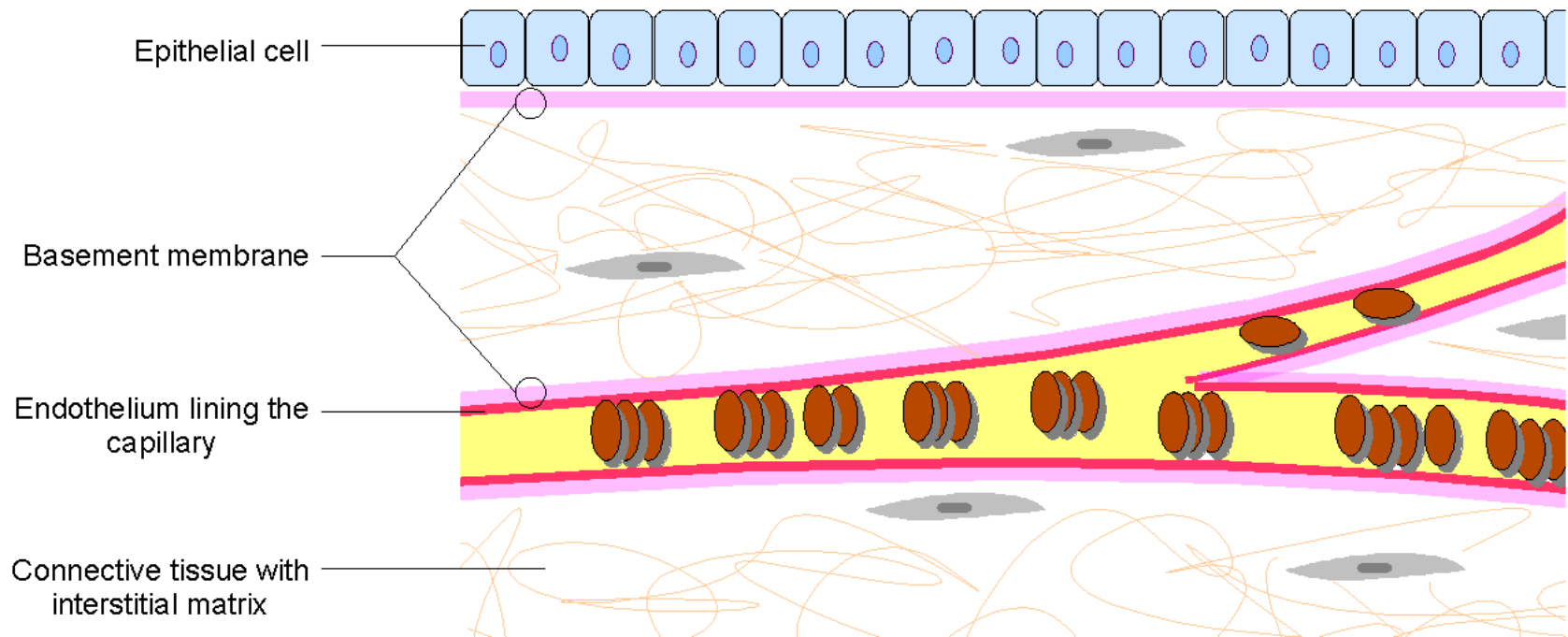
Myelin sheath is an electrical insulator, so nerve impulses jump across through the nodes of Ranvier of axon **causing rapid transmission of nerve impulses.**

Structure of a Typical Neuron



o) How do epithelial tissues get their supply of oxygen and nutrients, if they don't have a blood supply?

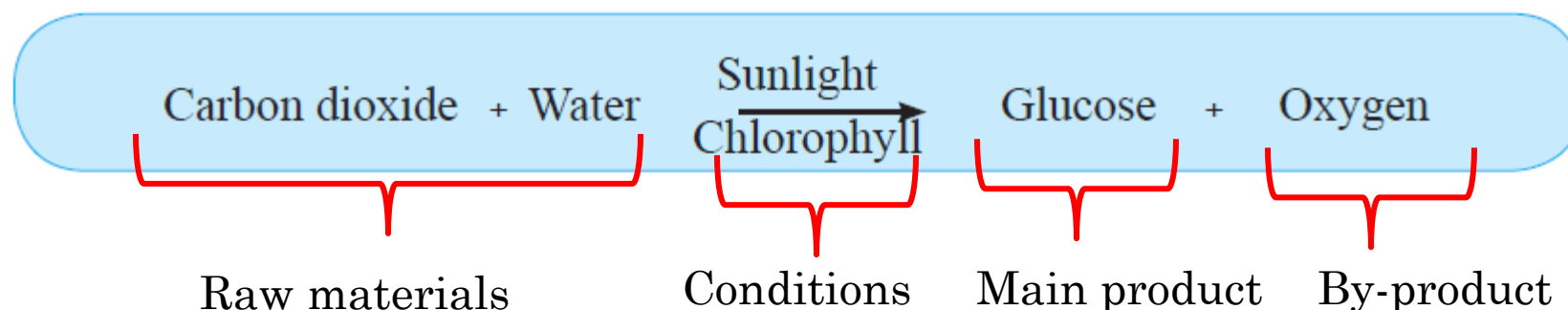
From blood vessels in underlying connective tissue, it diffuses into epithelial cell through basement membrane.



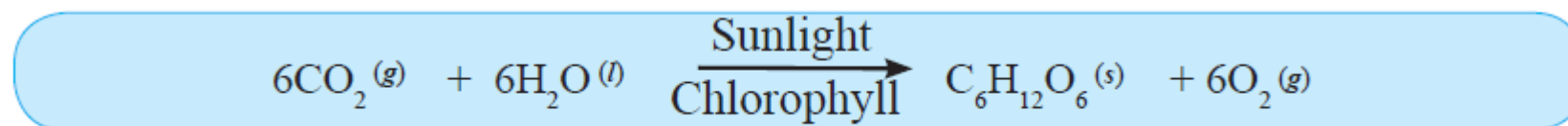
## QUESTION 02

a) State the word equation and balanced chemical equation for the process of photosynthesis.

Photosynthesis can be expressed by a word equation as given below.



The balanced chemical equation for photosynthesis is,



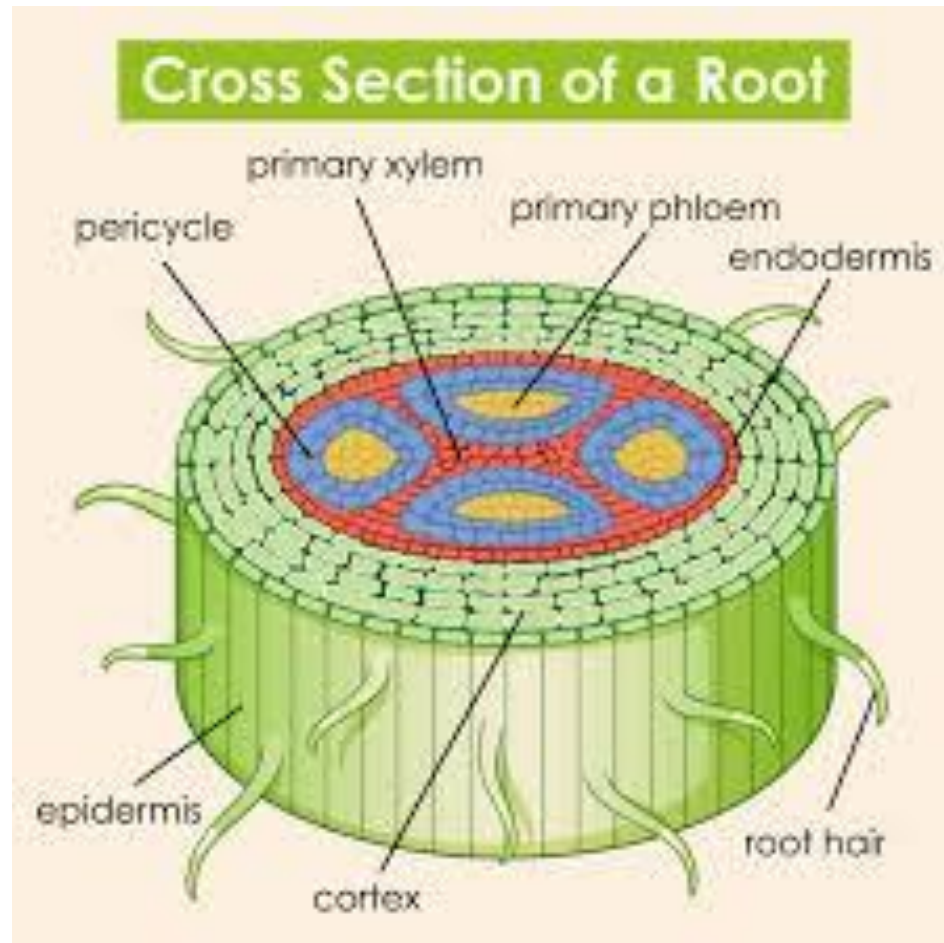
**NOTE- Carbon dioxide, Water, Sunlight & Chlorophyll Are The 4 “Factors” Necessary To Carry Out The Process of Photosynthesis**



## QUESTION 02

b) Using a flow chart, write the pathway of a water molecule from the soil to the leaf cell.

Soil  
↓  
Root Hair  
↓  
Cortex  
↓  
Endodermis  
↓  
Root Xylem



## CONTINUED...

Root Xylem



Stem Xylem



Stalk/Petiole



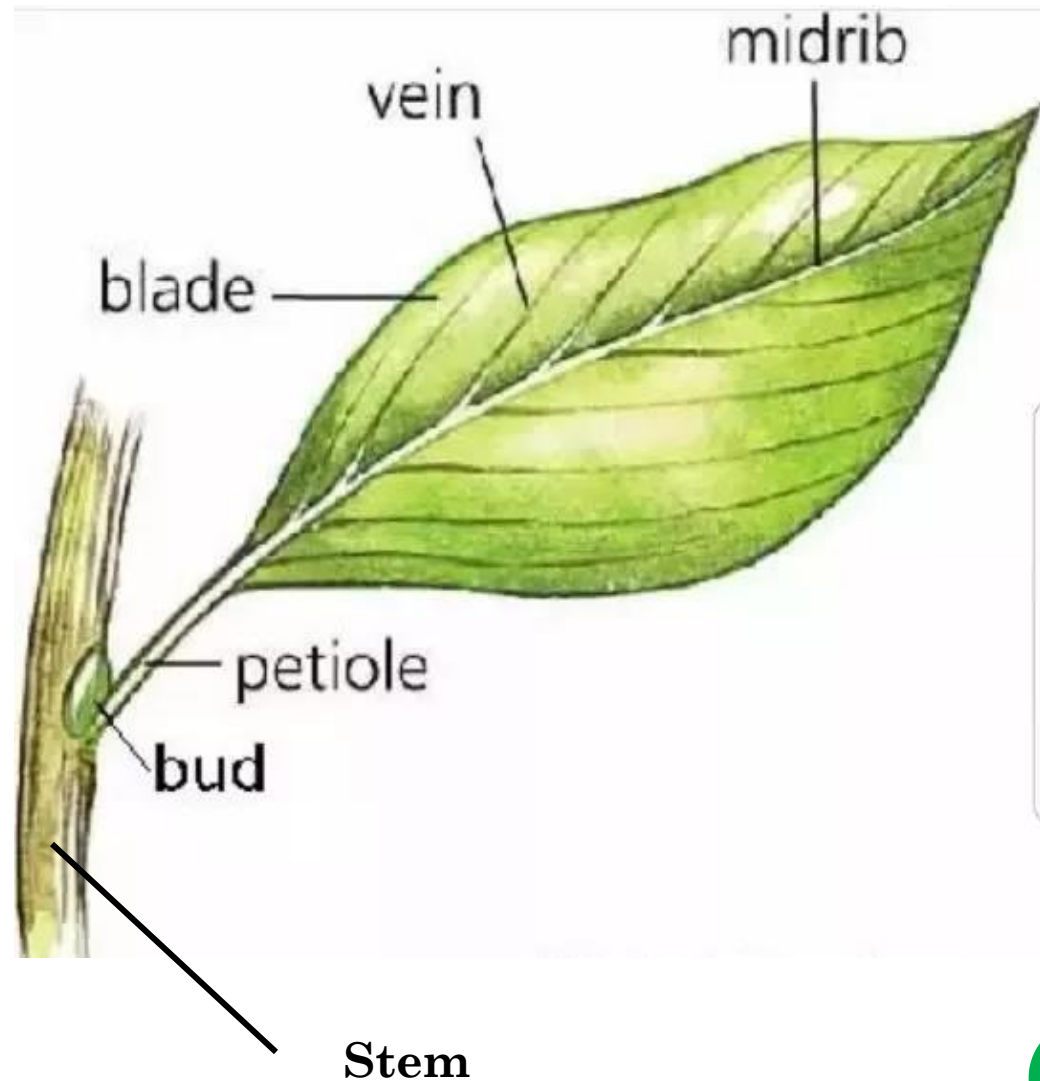
Midrib



Veins



Leaf Cells



## QUESTION 02

c) Why is the process of photosynthesis also called “Carbon fixation”?

Carbon **C** from the carbon dioxide **CO<sub>2</sub>** in the atmosphere is “fixed” into glucose (product) **C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>**

d) Briefly describe the fate of glucose produced in photosynthesis.

- **Glucose** is *temporarily* stored in the form of **starch** in leaves.
- It is converted to **sucrose** for translocation in phloem. (as starch is insoluble and sucrose is soluble)
- It is re-converted to **starch** and stored in different parts of plant. E.g. fruits, vegetables, roots

## QUESTION 02

e) State the basic steps of the experiment used to test whether photosynthesis occurred/not.

1. Pluck a leaf from a plant which was in sunlight and boil in water (For about 5 minutes).
2. Place it in the test tube with alcohol and boil in a water bath.
3. Wash the leaf well.
4. Place the leaf on white tile, put few drops of iodine solution onto it and observe the colour change.

- Play Video

Leaf Starch Test

<https://www.youtube.com/watch?v=VeU7ULL9Usw>

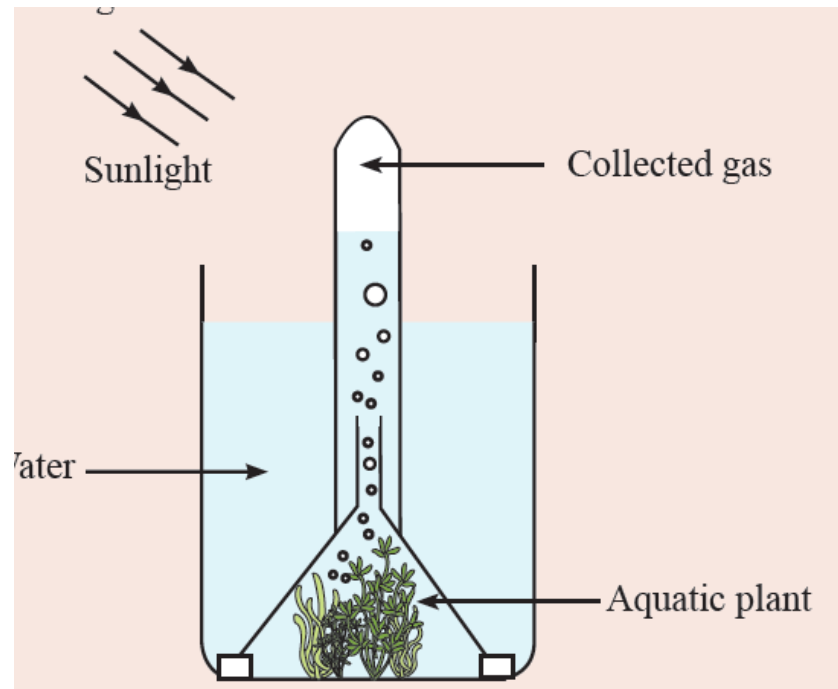
## Reasons behind certain steps of the experiment (extra note)

- **Leaf kept in sunlight is taken-** *So that photosynthesis has taken place in leaf, hence starch is present.*
- **Boil in water for 5 minutes-** *To kill cells in leaf, this allows entry and exit of substances into cells without any hindrance.*
- **Place leaf in test tube with alcohol-** *Chlorophyll dissolves in organic solvents like alcohol. Hence, by placing the leaf in alcohol and boiling it, Chlorophyll present in leaf can be removed. Chlorophyll is removed so that the leaf becomes pale and Chlorophyll will not mask any colour change in starch test.*
- **Boil test tube with alcohol in a water bath-** *As alcohol is highly inflammable, directly holding the test tube to Bunsen flame is dangerous.*
- **Wash the leaf well-** *As iodine dissolves in alcohol, entry of iodine into cells is delayed if alcohol is present in leaf. Hence the leaf soaked in alcohol must be washed well to remove all alcohol present before adding iodine.*
- **Leaf placed on white tile before adding iodine-** *Iodine does not react with the white tile. Since it is a white, the colour change can be observed clearly.*

## QUESTION 02

f) Suggest an alternative experiment that can be used to measure the **rate** of photosynthesis.

- By counting the bubbles of oxygen evolved in unit time/
- By measuring the volume of oxygen gas collected in unit time.



## QUESTION 02

g) When testing for factors of photosynthesis in the laboratory, the plant used must be kept in dark for 48 hours. Why?

To completely de-starch the leaf.

If a plant is kept in dark, photosynthesis does not take place in the plant. So the plant relies on previously stored starch for food, but all these would be used up within 2 days (48 hours).

Hence after 48 hours the plant would be starch-free (destarched).

& Then it is exposed to sunlight when testing for the factors. This will ensure that any starch that is produced as a positive result of the test was solely “newly produced starch” and not the previously “stored starch.”

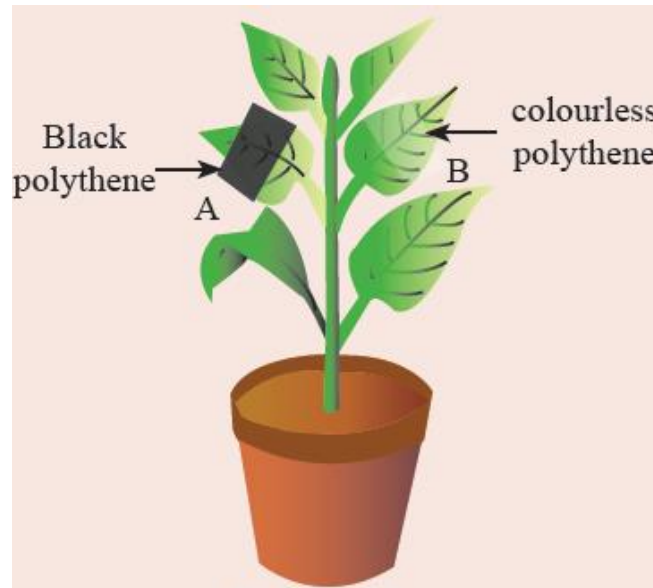


## QUESTION 02

h) State briefly how the following factors are eliminated in the experiments related to testing factors needed for photosynthesis;

i) Sunlight

Cover the leaf with black paper / polythene



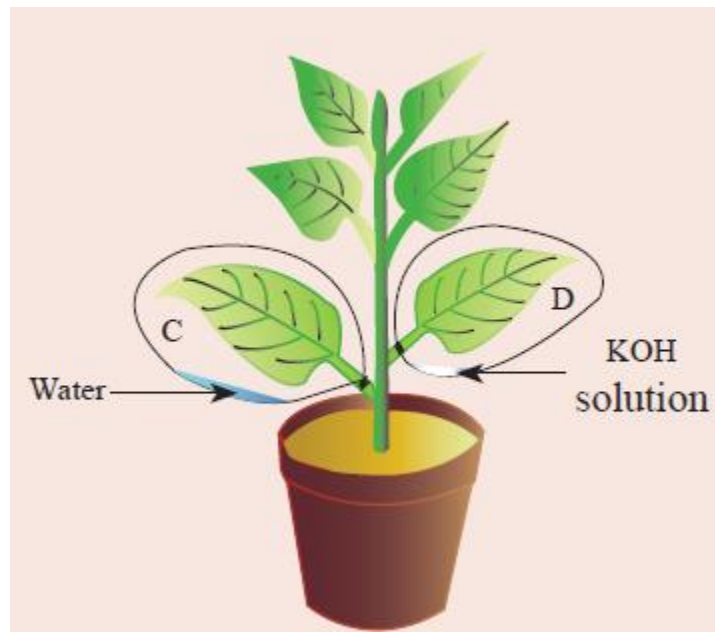
## QUESTION 02

h) ii) Carbon dioxide

Using KOH solution

Carbon dioxide is an acidic gas. KOH is a strong basic solution. Therefore KOH can absorb  $\text{CO}_2$

NOTE:- NaOH can also be used.



## QUESTION 02

h) iii) Chlorophyll

Using mosaic leaves -leaves with both white and green areas. White areas have no chlorophyll.



## QUESTION 02

h) iv) State the principle behind the experiment that proves water is necessary for photosynthesis.

Scientists have shown the need of water for photosynthesis using water with O-18 isotope.

If we water the plant with water made of O-18 isotope, the products formed after photosynthesis will have O-18 in them.

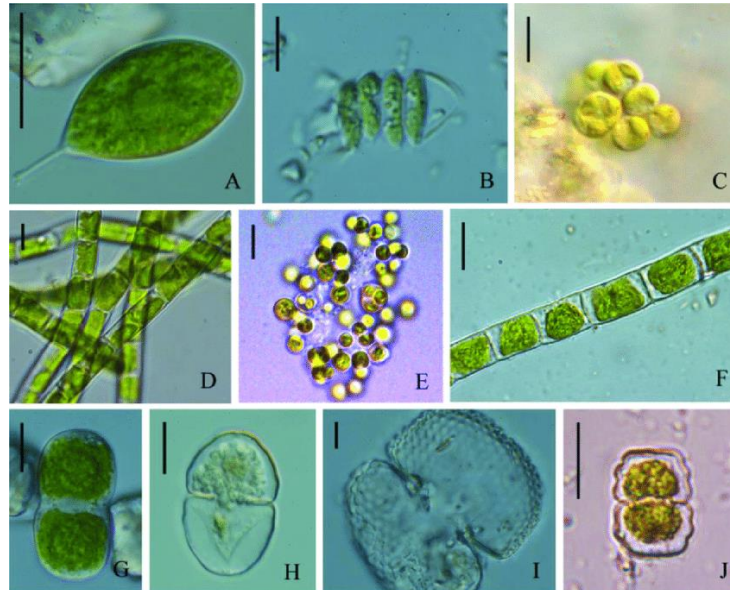
(O-18 is a radioisotope and can be detected using special radiation detectors.)

## QUESTION 02

j) “Green plants are the sole organisms that have the ability to do photosynthesis”.

False. Photosynthesis can take place in any organism that has chlorophyll.

E.g. Green Algae, Cyanobacteria, *Euglena*

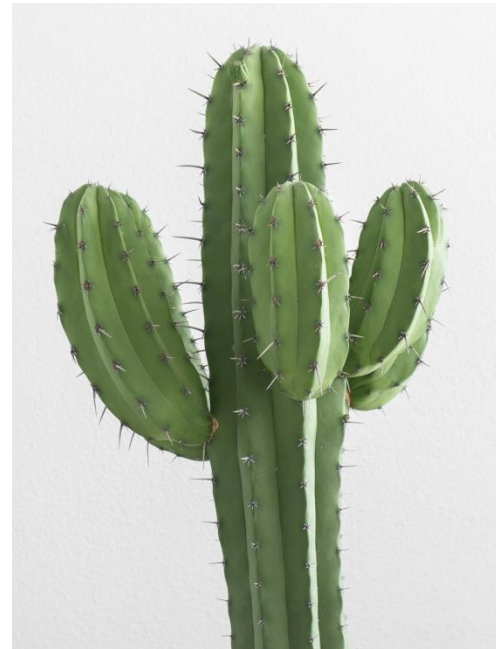


## QUESTION 02

“Photosynthesis takes place in leaves only”.

False. Photosynthesis can take place in any part that has chlorophyll.

E.g. sepals of a flower, green stems



## QUESTION 03

a) State how the following mixtures are termed based on their components and homogeneous/heterogenous nature.

i) Brass

**Solid-Solid Homogeneous**

Made of 65% Cu, 35% Zn

iii) Sugar solution

**Solid-Liquid Homogeneous**

Made of sugar + water





## QUESTION 03

a)

*“Solubility of a gas decreases with increasing temperature”*

ii) Carbon dioxide gas in cold water

Gas-Liquid Homogeneous

Carbon dioxide gas in hot water

Gas-Liquid Heterogeneous



## QUESTION 03

b) Define the term “solvent”.

The component present in excess amount

Solute + Solvent --- > Solution

Sugar + Water ----- Sugar Solution

## QUESTION 03

c) John dissolved **equal amounts of sugar** by stirring at a constant rate in two separate glasses, both filled with **equal volumes of water**. One glass had **hot water** and the other glass had **cold water**.



i) What could be the observation of the above experiment?

**More sugar dissolves faster in hot water than cold water.**

ii) State 2 conclusions you can arrive from the simple experiment above.

- **Temperature is a factor that affects solubility**
- **Solubility of solids increases as temperature increases.**

## QUESTION 03

d) John added **equal amounts of sugar** in two separate glasses, one filled with 100mL of **water** (which is polar) and the other filled with 100mL of **kerosene** (which is non-polar). Both were maintained at the **same temperature** and stirred at constant rate.



i) What could be the observation of the above experiment?

**Sugar dissolves well in water but not much in kerosene.**

ii) State 3 conclusions you can arrive from the simple experiment above.

- **Nature of solvent affects solubility.**
- **Like dissolves Like.**
- **Sugar is polar.**

## QUESTION 03

e) State 4 factors affecting solubility of a gas.

### 1. Temperature

*Temperature High ----> Solubility Low*

(but for solids, when temperature high, solubility high)

### 2. Pressure

*Pressure High ----> Solubility High*

### 3. Nature/ Type of gas

### 4. Nature of solvent

## QUESTION 03

f) 175.5 g of NaCl was dissolved in 2000ml of water. Express the composition of the solute as  
i) mass fraction (m/m) *Density of water  $1\text{gcm}^{-3}$*

$$\text{m/m} = \frac{\text{Mass of NaCl}}{\text{Total mass}} = \frac{175.5\text{g}}{175.5\text{g} + 2000\text{g}} = 0.081$$

$$2000\text{ml} = 2000\text{cm}^3 = 2000\text{g}$$

(because  $1\text{cm}^3 = 1\text{g}$  from density)

NOTE; *Mass Fraction, Volume Fraction & Mole Fraction Has No Units*

## QUESTION 03

f) **175.5 g of NaCl was dissolved in 2000ml of water.** Express the composition of the solute as

ii) Mass percentage %

iii) ppm

*Fraction x 100 = Percentage*

*Fraction x 1 000 000 = ppm (parts per million)*

**Mass Fraction x 100 = Mass Percentage**

**0.081 x 100 = 8.1 %**

**0.081 x 1 000 000 = 81000 ppm**

f) 175.5 g of NaCl was dissolved in 2000ml of water (H<sub>2</sub>O). Express the composition of the solute as

iv) Mole fraction

$$\text{No. of moles (mol)} = \frac{\text{Given Mass (g)}}{\text{Molar Mass (g mol}^{-1}\text{)}}$$

$$n = \frac{m}{M}$$

$$\text{No. of moles of NaCl} = \frac{175.5 \text{ g}}{23 + 35.5 \text{ g mol}^{-1}} = 3 \text{ mol}$$

$$\text{No. of moles of H}_2\text{O} = \frac{2000 \text{ g}}{(2 \times 1) + 16 \text{ g mol}^{-1}} = 111.11 \text{ mol}$$

$$\begin{aligned} \text{Mole Fraction} &= \frac{\text{Moles of NaCl}}{\text{Total Moles}} = \frac{3 \text{ mol}}{3 \text{ mol} + 111.11 \text{ mol}} \\ &= 0.026 \end{aligned}$$

## QUESTION 03

f) **175.5 g of NaCl was dissolved in 2000ml of water (H<sub>2</sub>O).** Express the composition of the solute as v) mass/volume (m/V)

$$\frac{\text{m}}{\text{V}} = \frac{\text{mass of solute (g)}}{\text{volume of solution (dm}^3\text{)}} = \frac{175.5\text{g}}{2\text{dm}^3} = 87.75 \text{ gdm}^{-3}$$

$$1000\text{cm}^3 = 1\text{dm}^3$$

$$\text{So, } 2000\text{cm}^3 = 2\text{dm}^3$$

*NOTE:-  $m/V$  is not density even though it has similar units. (Because  $m$  and  $V$  are not of the same material)*



## QUESTION 03

f) 175.5 g of NaCl was dissolved in 2000ml of water (H<sub>2</sub>O). Express the composition of the solute as vi) concentration

$$\text{Concentration} = \frac{\text{Moles of Solute (mol)}}{\text{Volume of Solution (dm}^3\text{)}} \quad (\text{mol dm}^{-3})$$

$$c = \frac{n}{V}$$

$$\begin{aligned} &= \frac{3 \text{ mol}}{2 \text{ dm}^3} \\ &= 1.5 \text{ mol dm}^{-3} \end{aligned}$$

## QUESTION 03

g) 50 cm<sup>3</sup> of alcohol was dissolved in 100cm<sup>3</sup> of water.  
Express the composition of the solute as a volume fraction (V/V)

$$\begin{aligned} V/V &= \frac{\text{Volume of Solute}}{\text{Volume of Solution}} = \frac{50 \text{ cm}^3}{50 \text{ cm}^3 + 100 \text{ cm}^3} \\ &= 0.33 \end{aligned}$$

## QUESTION 03

h) How do you prepare a 250cm<sup>3</sup> solution of alcohol with volume fraction (V/V) 0.25?

$$V/V = \frac{\text{Volume of Solute (usually cm}^3\text{)}}{\text{Volume of Solution (usually cm}^3\text{)}}$$

$$0.25 = \frac{x}{250\text{cm}^3}$$

$$x = 62.5 \text{ cm}^3$$

Take 62.5cm<sup>3</sup> of alcohol into a 250cm<sup>3</sup> volumetric flask and top it up to 250cm<sup>3</sup> level mark using distilled water.



i) 36g of glucose was dissolved in 250ml of water. Find the concentration of glucose in the solution.

$$\text{Concentration} = \frac{\text{Moles of Solute}}{\text{Volume of Solution}}$$

Moles of glucose? Find it first!

$$n = \frac{m}{M}$$

$$= \frac{36 \text{ g}}{180 \text{ g mol}^{-1}} = 0.2 \text{ mol}$$

*To convert  $\text{cm}^3$  to  $\text{dm}^3$  divide by 1000 or multiply by  $10^{-3}$*

*$250\text{ml} = 250\text{cm}^3$ , that is  $250 \times 10^{-3} \text{ dm}^3$*

$$c = \frac{n}{V}$$

$$= \frac{0.2 \text{ mol}}{250 \times 10^{-3} \text{ dm}^3} = \frac{0.2 \times 10^3}{250} = \frac{200}{250}$$

$$= 0.8 \text{ mol dm}^{-3}$$

j) Concentration of glucose in  $200\text{cm}^3$  glucose solution was  $0.5\text{mol dm}^{-3}$ . Find the mass of glucose dissolved.

$$c = \frac{n}{V}$$

$$0.5 \text{ mol dm}^{-3} = \frac{n}{200 \times 10^{-3} \text{ dm}^3}$$

$$n = 0.1 \text{ mol}$$

$$n = \frac{m}{M}$$

$$0.1 = \frac{m}{180}$$

$$m = 18 \text{ g}$$

k) i) What is a standard solution?

A solution having an accurately known concentration.

ii) State the basic steps to prepare  $500\text{cm}^3$  of a standard solution of  $2\text{mol dm}^{-3}$  NaCl.

Find the mass of NaCl required (same steps as j).

$$2 \times 0.5 \times 58.5 = 58.5\text{g}$$

- 1) Weigh 58.5g using a balance in the laboratory.
- 2) Add 58.5g into a  $500\text{cm}^3$  volumetric flask.
- 3) Add a little amount of water and mix well.
- 4) Add more water and top up till the  $500\text{cm}^3$  level mark.

## IMPORTANT VOLUME CONVERSIONS

*You know*  $1\text{cm}^3 = 1\text{mL}$

*So*  $1000\text{cm}^3 = 1000\text{mL}$

*But you also know*  $1000\text{mL} = 1\text{L}$

*So*  $1000\text{cm}^3 = 1\text{L} \text{ --- (1)}$

*Remember that*  $10\text{ cm} = 1\text{ dm}$

*Cubing both sides*  $(10\text{ cm})^3 = (1\text{ dm})^3$

*Gives you*  $1000\text{ cm}^3 = 1\text{ dm}^3 \text{ --- (2)}$

*From (1) and (2)*  $1\text{L} = 1\text{ dm}^3$

*Finally we can summarize:*

$$1\text{dm}^3 = 1\text{L}$$

$$1\text{dm}^3 = 1000\text{mL}$$

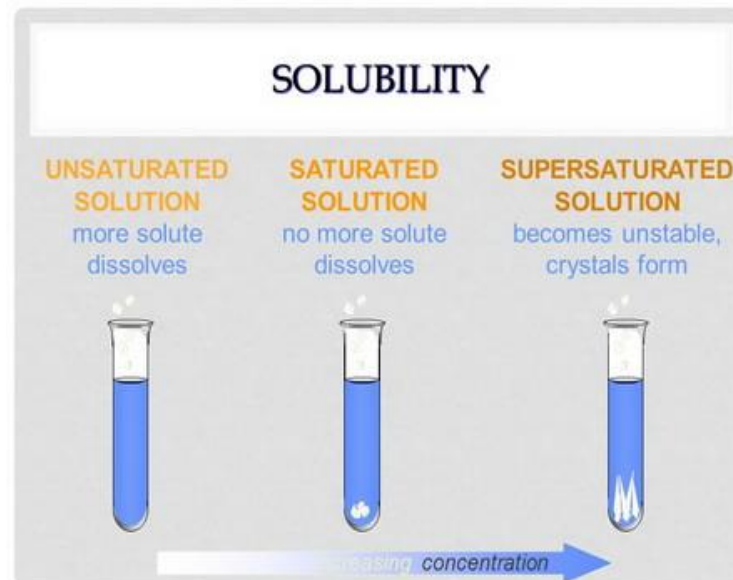
$$1\text{dm}^3 = 1000\text{cm}^3$$

**TIP to convert  $\text{cm}^3$  to  $\text{dm}^3$  :  $\times 10^{-3}$**

# QUESTION 03

1) i) What is meant by a saturated solution?

A saturated solution is a solution having **maximum concentration** of a substance that stays dissolved in a solution at a certain temperature.





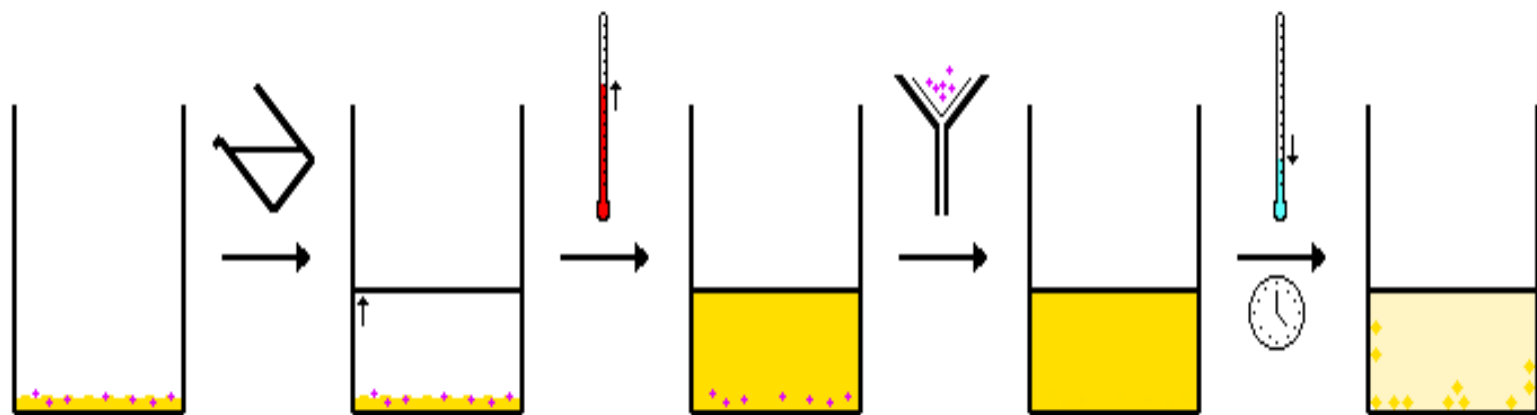
## QUESTION 03

1) ii) What is the use of re-crystallization process?

- Recrystallization is used to separate pure substances from solid, crystalline substances carrying *impurities*.
- Crystals of high quality without impurities can be obtained by recrystallization.

## 1) Explain briefly the steps of re-crystallization.

1. First, the impure solid is dissolved in a hot solvent till it becomes saturated.
2. Then, to separate the impurities in the impure solid (the impurities are now dissolved in solution), above solution is filtered while it is still hot.
3. Pure crystals of the solid is obtained by cooling the filtrate.
4. *Extra:- However, the crystals that are formed within the filtrate. So finally, the crystals are isolated by drying the filtrate in an oven or by using a special filtration technique.*



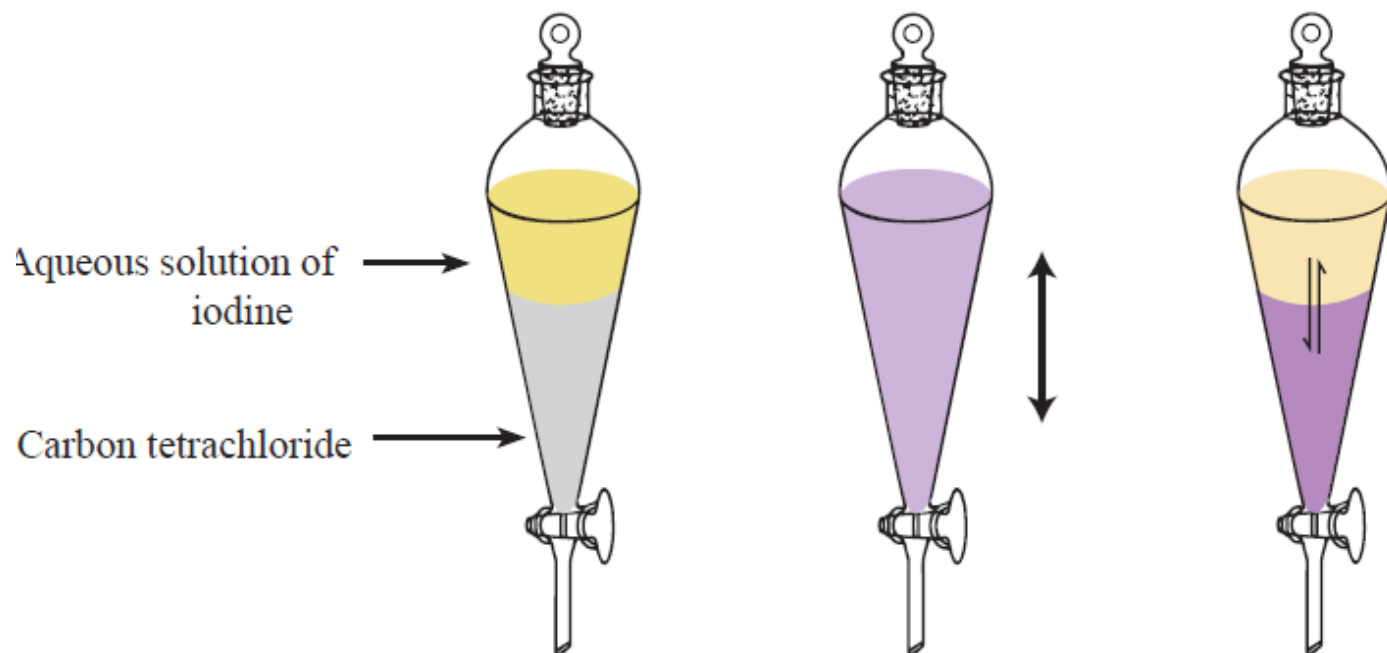
# PRINCIPLE BEHIND RECRYSTALLIZATION

## **NOTE:-**

- In other words, just like increasing the temperature increases solubility, decreasing the temperature, decreases the solubility and makes the solvent become saturated, hence inducing crystallization.
- If there are any soluble components present as impurities, they are not crystallized as the solution is not saturated in them as they are present only in minor quantities.

## QUESTION 03

m) Explain the observations that take place when an aqueous solution of iodine is mixed with a carbon tetrachloride solution in a separating funnel.



## OBSERVATIONS....

- When carbon tetrachloride is added to an aqueous solution of iodine, they do not mix, and the layers get separated. (Aqueous solution floats on top of carbon tetra chloride)
- Shake the separating funnel, after some time, it can be seen that the carbon tetrachloride layer turns violet while the aqueous layer becomes pale.
- After this, carbon tetra chloride layer is separated from aqueous layer and finally iodine is recovered by evaporating carbon tetrachloride.

## Important to remember...

- Water : Colourless
- Carbon Tetrachloride: Colourless
- Water + *more* Iodine = Brown
- Water + *less* iodine = Pale yellow
- Carbon Tetrachloride + *less* Iodine = pinkish purple
- Carbon Tetrachloride + *more* iodine = Violet/ Purple
  
- Iodine is soluble in both polar water, and non-polar carbon tetrachloride. (exception)
- BUT Iodine is MORE SOLUBLE in carbon tetrachloride than water.
- Hence, Iodine can be considered as more non-polar than polar.

## QUESTION 03

n) i) Briefly state the principle behind fractional distillation.

- If two liquids are to be separated by fractional distillation, there should be a **considerable difference in their boiling points**.
- That means, their volatilities need to be considerably different.
- *(Higher the volatility, lesser the boiling point)*
- Here, the vapourised vapour contains a higher percentage of the more volatile component and a lower percentage of the less volatile component.

## QUESTION 03

n) ii) ii) State one basic difference between simple distillation and fractional distillation. (Answer based on the volatility of components that are present in the mixture being separated.)

- Simple distillation is used to separate components in a mixture which contains **ONE** volatile component with other non-volatile components.
- If the solution or the mixture subjected to separation contains **several** volatile components, we use fractional distillation.



## QUESTION 03

n) iii) State an industrial use of steam distillation.

Extraction of essential oils from plant parts

o) i) State the separating techniques used in extraction of salt from sea water.

Evaporation

Crystallization

## QUESTION 03

ii) State the geographical and environmental factors to be considered when setting up a saltern?

1. A flat land situated closer to a coastal area to obtain sea water easily .
2. Presence of a clayey soil with minimum percolation of water .
3. Prevailence of dry and hot climate with bright sunlight and wind throughout the year .
4. An area with minimum rainfall.

## QUESTION 03

iii) State the salts that crystallize in the tanks of a saltern and mention the relative concentration at which they crystallize.

Concentration of sea water- c

1 <sup>st</sup> Tank	Large Shallow	CaCO <sub>3</sub>	2c
2 <sup>nd</sup> Tank	Medium	CaSO <sub>4</sub>	4c
3 <sup>rd</sup> Tank	Small	NaCl	10c

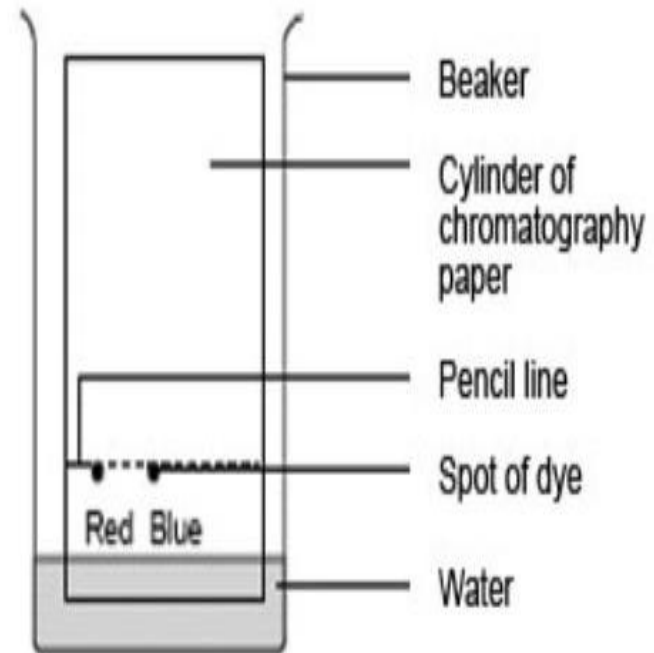
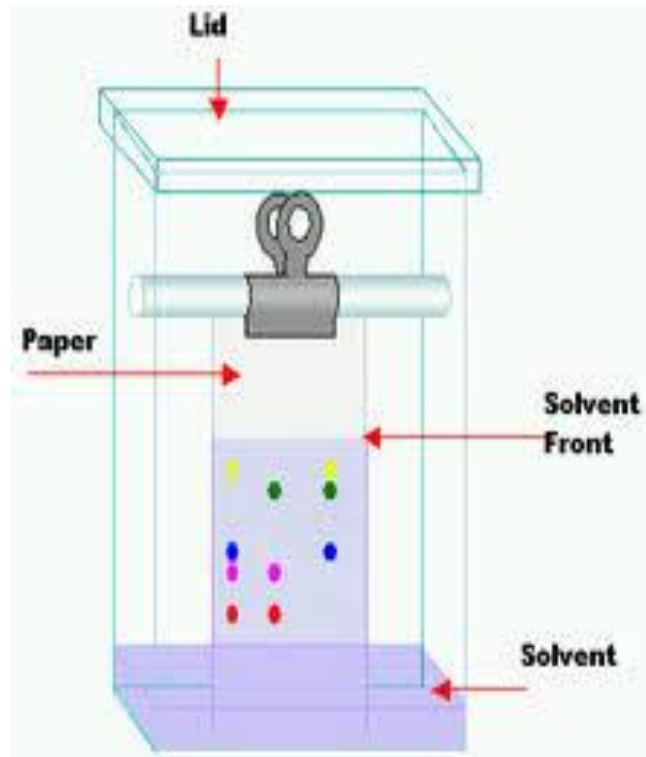
## QUESTION 03

iv) Explain what is meant by the term 'hygroscopic' using salt as an example.

**Pure sodium chloride is not hygroscopic. But if salt contains magnesium chloride and magnesium sulphate, it becomes bitter and hygroscopic, when exposed to the atmosphere.**

**This makes magnesium chloride and magnesium sulphate absorb moisture in the atmosphere and go into solution form, with the elapse of about six months most of them get removed, salt is retained as a solid.**

# CHROMATOGRAPHY



- Play video

## Paper Chromatography

<https://www.youtube.com/watch?v=yosecfE98Ok>

[https://www.youtube.com/watch?v=23W5Z\\_redfs](https://www.youtube.com/watch?v=23W5Z_redfs)

## QUESTION 03

i) What are the factors that affect the rate of upward movement of components in a mixture separated using paper chromatography?

The rate of upward movement depends on

- **The forces of attraction of the components of the mixture, to the stationary phase (the paper)**
- **Molar mass of the components in the mixture**
- *For example, if one component in the mixture is strongly attracted to the stationary phase (the paper), its rate of upward movement decreases. If there is another component in the mixture that is relatively less attracted to the mixture, it moves up faster through the stationary phase.*
- Because of this difference in the speed of movement of the components in the mixture, they get separated from one another.

## QUESTION 03

ii) Suggest an example of the mobile phase to be used if the mixture to be separated using chromatography contains non-polar substances.

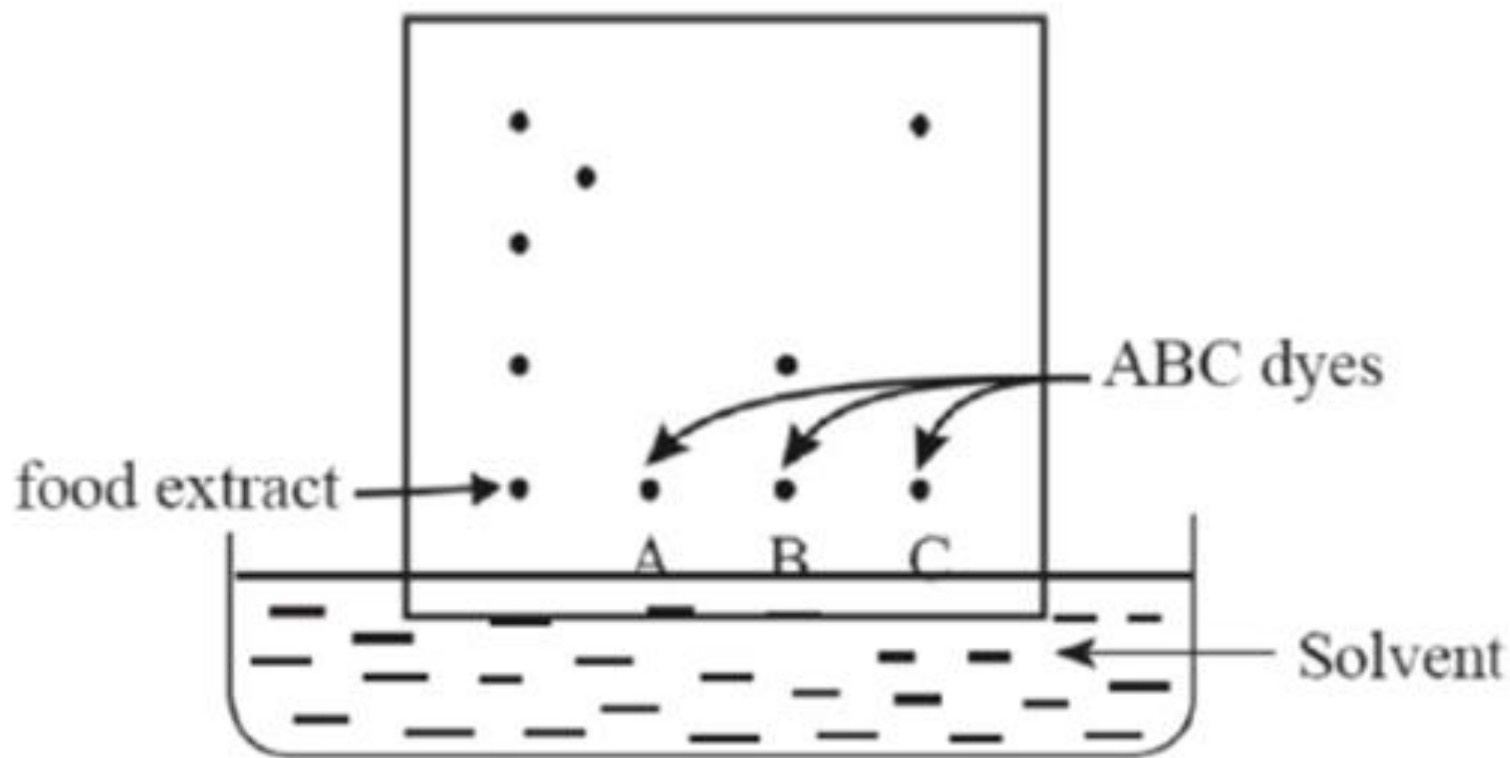
Ether (non polar )

Non-polar solvent to dissolve non-polar components of the mixture

*(Water, Acetone, Alcohol- polar solvents)*



3) q) The diagram below shows the observations seen after dyes in a food extract mixture are separated using paper chromatography. Dyes A, B, C are also spotted separately as a reference.

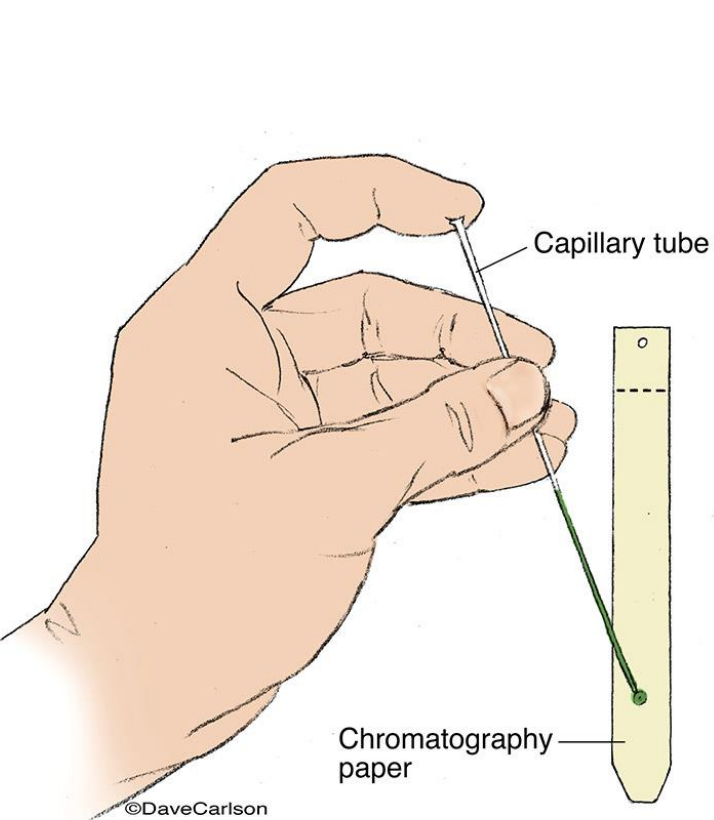


## QUESTION 03

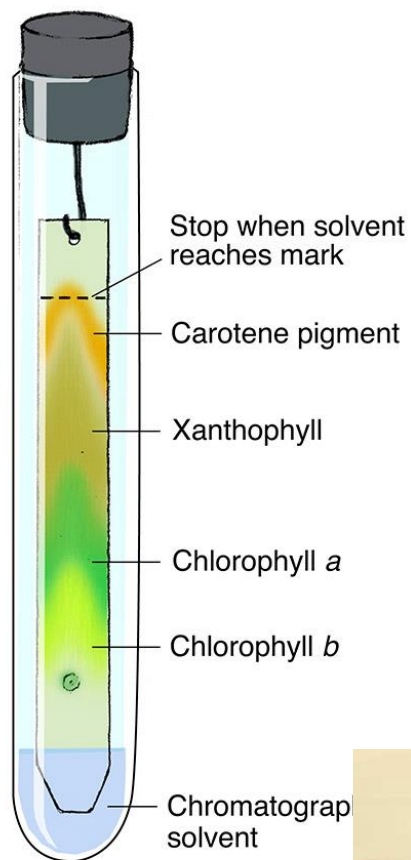
- According to this result, what dyes out of A, B and C could be present in the food sample?

B & C

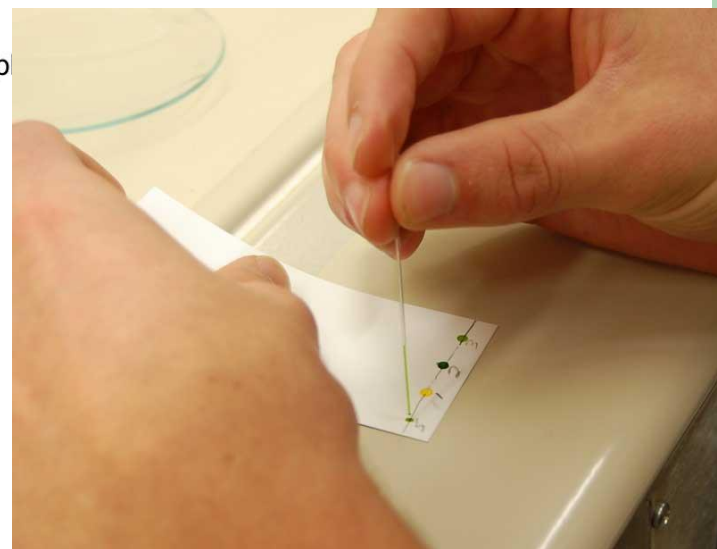
- How many components have been separated in the dye C? 1
- What could be the possible reason for non-separation of components in dye A? dye A's components maybe having a different polarity than the solvent so it doesn't dissolve / dye A is strongly binded to the paper
- What is the apparatus usually used to spot the dye and food extract onto the paper? Capillary tube



A. Applying spot of chlorophyll pigment



B. Final chromatogram



## QUESTION 04

On what basis are waves classified as electromagnetic and mechanical waves?

Requirement of a medium for propagation/not.

(Mechanical waves need a medium for propagation,

Electromagnetic waves do not need a medium)

b) On what basis are waves classified as transverse and longitudinal waves?

Based on the way particles in the medium move when the wave travels through them.

Transverse- perpendicular to wave

Longitudinal- parallel to wave

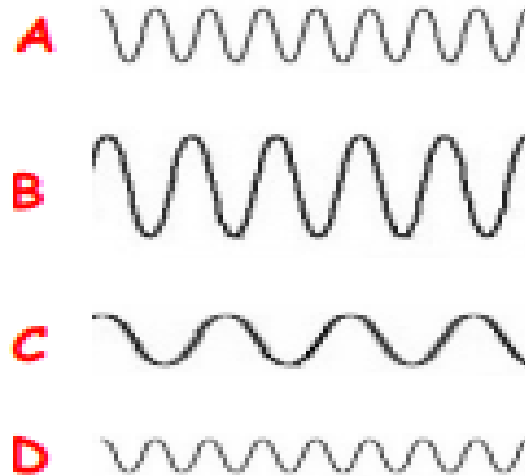
- Play Video

Movement of particles

<https://www.youtube.com/watch?v=yd-G6KYwzvA>

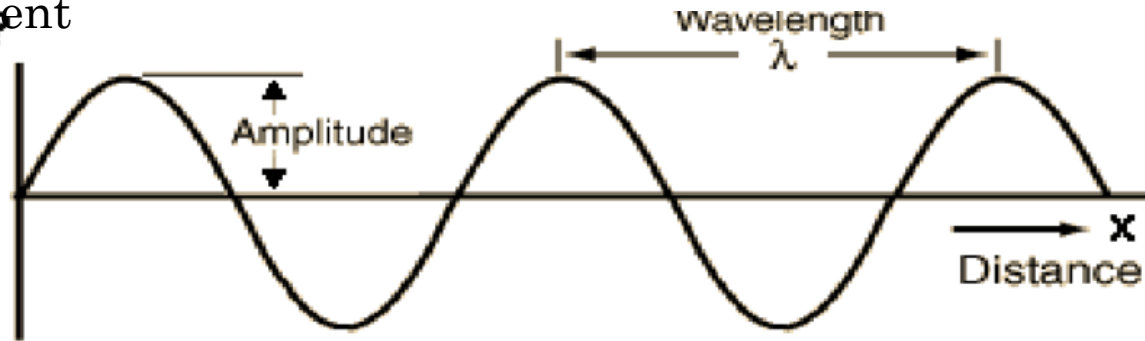
<https://www.youtube.com/watch?v=wofUndFivZE>

c) The diagram shows four waves, A, B, C and D all drawn to the same scale.

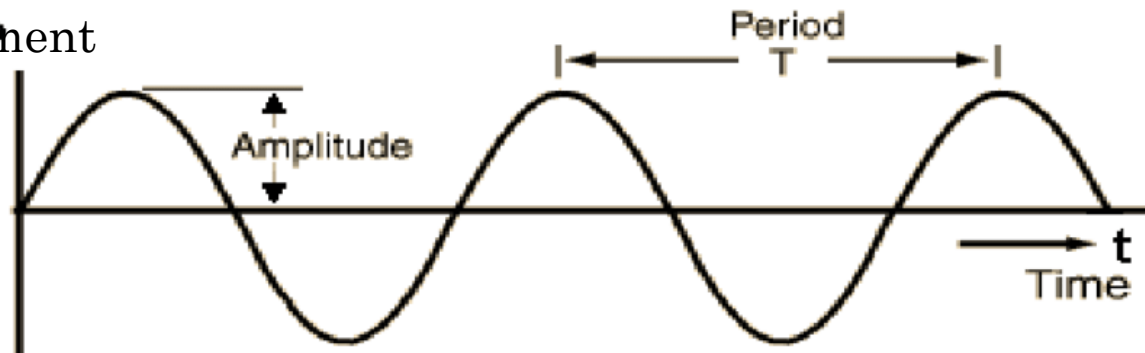


- Which wave has the highest frequency? **A & D**  
*Both A & D has the equal & lowest wavelength,  
Hence both of them have the highest frequency*
- Which wave has the highest amplitude? **B**
- Which wave has the longest wavelength? **C**
- Which wave has the greatest period? **C**

Displacement



Displacement



**Amplitude**---- Maximum displacement from the mean 0 position  
*“simply- the height of the wave”*

**Wavelength**---- Distance between a crest & adjacent crest OR  
Distance between trough & adjacent trough OR  
Distance between one point and next similar point/phase  
*“simply- the length of one wave”*

***Wavelength High.... Frequency Low.... Period High....***

## QUESTION 04

d) The frequency of the wave was 2Hz. What is its Period?

$$f = \frac{1}{T} \quad \frac{1}{2} = 0.5\text{s}$$

e) The wavelength of a wave was 2m. The frequency was 10Hz. What is the speed of the wave?

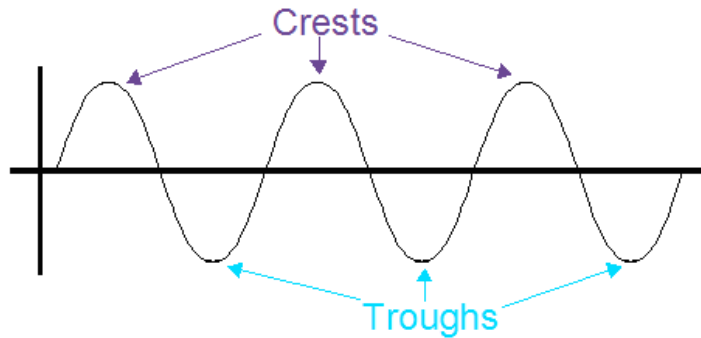
$$v = f \times \lambda$$

$$\begin{aligned} \text{Speed} &= \text{Frequency} \times \text{Wavelength} \\ &= 10\text{Hz} \times 2\text{m} \\ &= 20\text{ms}^{-1} \end{aligned}$$

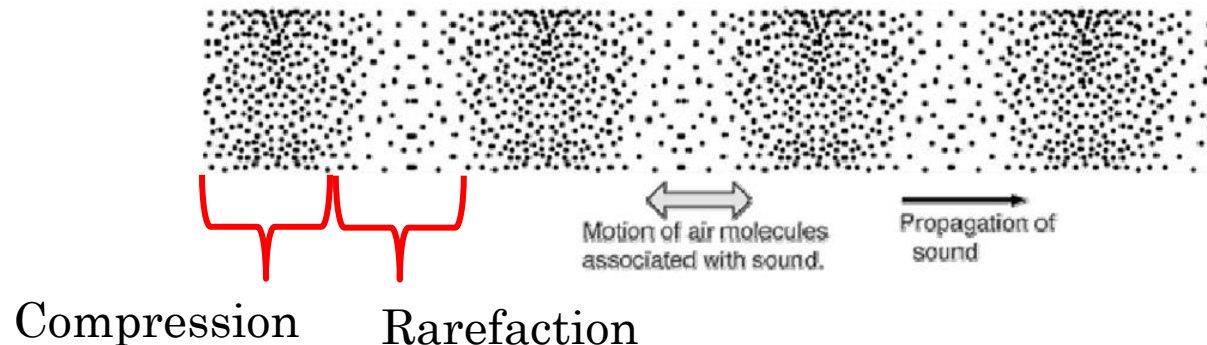


## QUESTION 04

f) Draw a sinusoidal wave and mark a crest and a trough.



g) Draw a longitudinal wave using dots representing air particles and label the compressions and rarefactions.



h) State the 3 main characteristics of sound and state their relationship with the physical quantity associated with them.

1. Pitch --- > Depends on Frequency

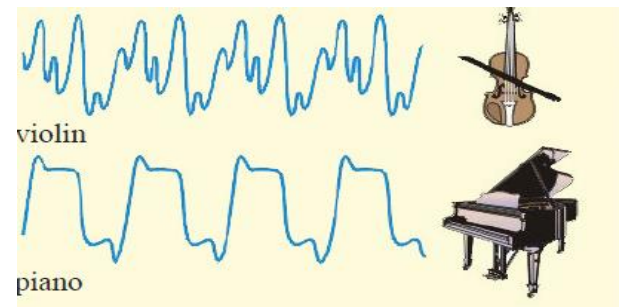
*Pitch high----- frequency high*

2. Loudness ---- > Depends on Amplitude

*Loudness high---- Amplitude high--- Energy high*

3. Quality of Sound ---- > Depends on Wave Form/Shape

It is the shape of the wave that makes a violin sound different from a piano even if other 2 characteristics are same.



## QUESTION 04

i) Briefly explain why there is a time lag to hear the sound of thunder even though both lightning and thundering initiate at the same time?

- We hear the sound of thunder a short while after we see the light from a lightning strike taking place at a distant point.
- We see the light emitted in a lightning strike when that light travels towards us and enters our eyes.
- Light travels at the speed of  $3 \times 10^8 \text{ ms}^{-1}$ . Therefore it takes only a very short time for us to see the light from a lightning strike.
- There is a short time gap between seeing the light and hearing the thunder because it takes a longer time for the sound wave to travel to our ear than it takes for the light to travel to our eyes from the point where the lightning strike took place.

## QUESTION 04

j) State 2 factors the speed of sound depends on.

1. Temperature
2. Medium

*Temperature High --- Speed High*

*Sound Speed in Solids > Liquids > Gases*

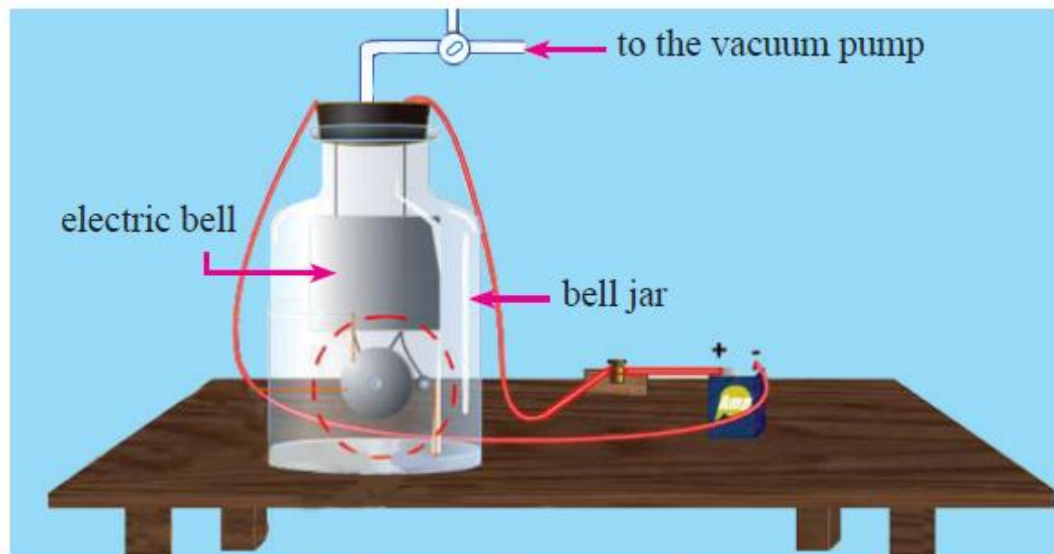
## QUESTION 04

k) How can we prove that sound is a mechanical wave?

Using the Bell Jar Vacuum Experiment

*Sound cannot travel in a vacuum.*

*Therefore sound is a mechanical wave.*



- Play video

<https://www.youtube.com/watch?v=ce7AMJdq0Gw>

Bell Jar Vacuum Experiment

below 20 Hz

20 Hz to 20,000 Hz

over 20,000 Hz

## QUESTION 04



1) Explain the terms-Hearing range of human, ultrasound, infrasound

Frequency range that can be heard by the human ear is from 20-20,00Hz.

This frequency range is known as **hearing range of human.**

Sounds of frequency below 20Hz are called **infrasound.**

Sounds of frequency above 20,000Hz are called **ultrasound.**

## QUESTION 04

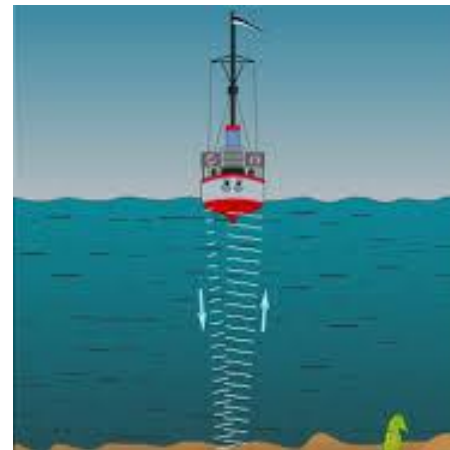
m) Time taken by ultrasound waves generated by ship to reach the bottom of the sea and return back to the detector at the bottom of a ship is 6s. What is the depth of the sea at that point? (Take the speed of sound in sea water as  $1400\text{ms}^{-1}$ )

Take the depth of the sea as 'd'

Distance travelled by sound

to bottom and back- '2d'

Total time for journey = 6s



$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$1400\text{ms}^{-1} = \frac{2d}{6\text{s}}$$

$$d = \frac{1400 \times 6}{2} = 4200\text{m}$$



## QUESTION 04

n) i) State the 3 main types of musical instruments.

1. Percussion Instruments
2. String Instruments
3. Wind Instruments



# String Instruments



Guitar



Banjo



Viola



Violin



Bass



Lute



Mandolin



Harp



Sitar



Cello

# Wind Instruments



## QUESTION 04

- ii) State separately, the factors that affect the frequency of the 3 types of musical instruments.
- iii) State separately, the relationship between the frequency and the factor mentioned above.

## ○ PERCUSSION INSTRUMENTS

Frequency (Pitch) Depends On:

- 1) **Area of membrane / metal plate**
- 2) **Tension of membrane**

*Area Low...Frequency High*

*Tension High... Frequency High*

## ○ STRING INSTRUMENTS

Frequency (Pitch) Depends On:

- 1) Length of the vibrating string
- 2) Tension of the string or the extent that the string is stretched
- 3) Mass of a unit length of the string

*Length Low... Frequency High*

*Tension High... Frequency High*

*Mass Low... Frequency High*



## ○ WIND INSTRUMENTS

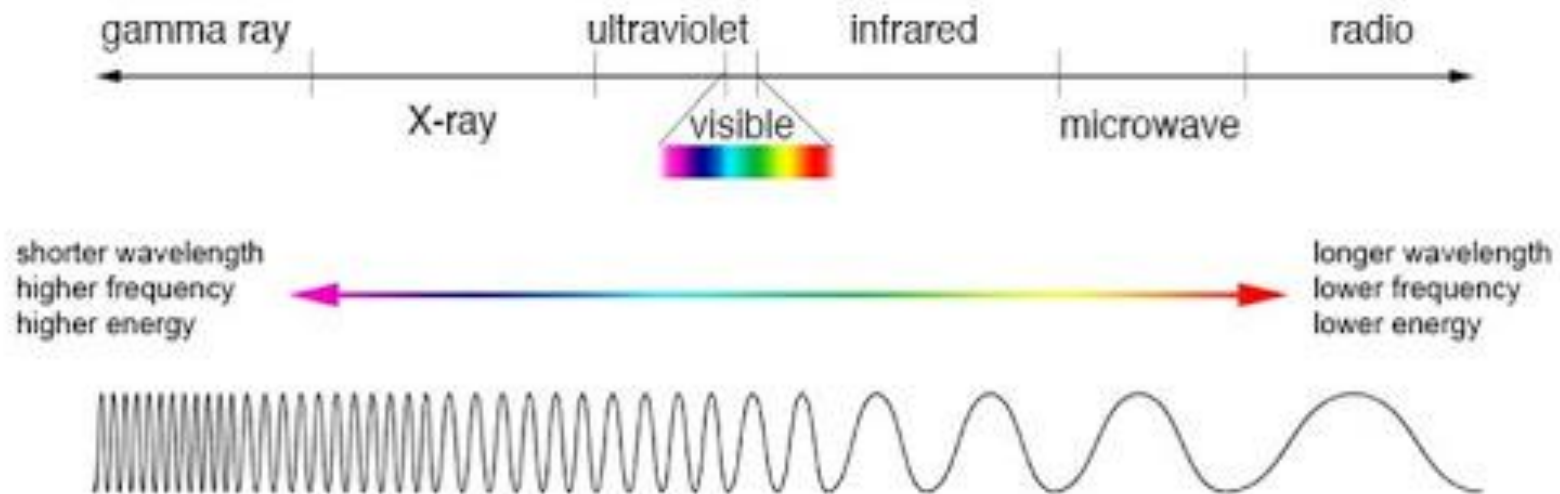
**Frequency (Pitch) Depends On:**

**1) The length of the air column.**

*Length Low ... Frequency High....*



o) Arrange the following in the ascending order of wavelength;  
gamma rays, ultraviolet rays, microwaves , X-rays



gamma rays < X-rays < ultraviolet rays < microwaves

# QUESTION 04

p) State 2 uses of infrared radiation

- Remote control signals
- Infrared camera
- Physiotherapy treatments
- Disease diagnosis (using heat photograph)



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