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+1 COMMON PUBLIC EXAMINATION - MARCH - 2020

TENTATIVE ANSWER KEY

SUBJECT: XI BOTANY (PS) **MARKS : 70**

Q.NO	CONTENT		MARK
I.	**PART-I** **CHOOSE THE CORRECT ANSWER:**		**15X1=15**
	TYPE - A	**TYPE - B**	
1	b) -196°C	d) Floridean starch	1
2	c) Distal	d) 3 ATP + 2 NADPH	1
3	c) Phellogen	d) 3500	1
4	d) 3500	a) Plastids	1
5	d) 3 ATP + 2 NADPH	c) Phellogen	1
6	b) Xylem would be on top and the phloem at the bottom	a) Thyrsus	1
7	a) Thyrsus	b) Lack of motile structures	1
8	c) Foliar bud, cauline bud	b) -196°C	1
9	d) Floridean starch	c) Distal	1
10	a) Plastids	d) Higher plants	1
11	d) Higher plants	d) 1898	1
12	d) 1898	b) Fabaceae	1
13	b) Lack of motile structures	c) Foliar bud, cauline bud	1
14	b) Fabaceae	d) 42	1
15	d) 42	b) Xylem would be on top and the phloem at the bottom	1
II.	**PART-II** **Answer any six of the following. Question No. 24 is compulsory**		**6X2=12**
16	**Archaebacteria** Archaebacteria are primitive prokaryotes and are adapted to thrive in extreme environments like hot springs, high salinity, low pH and so on. **Bacterial Plant diseases: (any two)** Bacterial blight, Fire blight ,Soft rot, Citrus canker, Angular leaf spot, Ring rot, Scab		1 1
17	**Protoplasm theory :** **Corti** first observed protoplasm. **Felix Dujardin** (1835) observed a living juice in animal cell and called it "**Sarcode**". **Purkinje** (1839) coined the term protoplasm for sap inside a plant cell. **Hugo Van Mohl** (1846) indicated importance of protoplasm. **Max Schultze** (1861) established similarity between Protoplasm and Sarcode and proposed a theory which later on called "**Protoplasm Theory**" by **O. Hertwig** (1892). **Huxley** (1868) proposed Protoplasm as a "**physical basis of life".**		**2**

18 **Transpiration as a "necessary evil":**

Reason :

Transpiration leads to loss of water, as stated earlier in this lesson 95% of absorbed water is lost in transpiration. It seems to be an evil process to plants. However, number of process like absorption of water, ascent of sap and mineral absorption directly relay on the transpiration. Moreover plants withstand against scorching sunlight due to transpiration. Hence the transpiration is a "**necessary evil**" as stated by **Curtis**. **2**

19 **Bolting:**

When they are treated with gibberellins. This sudden elongation of stem followed by flowering is called **bolting** **2**

20 **Substrate phosphorylation:**

ATP produced by the breakdown of substrate is known as substrate level phosphorylation. **2**

21 **Uses of herbarium: (Any four)**

- ❖ Herbarium provides resource material for systematic research and studies.
- ❖ It is a place for orderly arrangement of voucher specimens.
- ❖ Voucher specimen serves as a reference for comparing doubtful newly collected fresh specimens.
- ❖ Voucher specimens play a role in studies like floristic diversity, environmental assessment, ecological mechanisms and survey of unexplored areas.
- ❖ Herbarium provides opportunity for documenting biodiversity and studies related to the field of ecology and conservation biology.

2

22 **Difference between Gymnosperms and Angiosperms (any four):**

S.No	Gymnosperms	Angiosperms
1.	Vessels are absent [except Gnetales]	Vessels are present
2.	Phloem lacks companion cells	Companion cells are present
3.	Ovules are naked	Ovules are enclosed within the ovary
4.	Wind pollination only	Insects, wind, water, animals etc., act as pollinating agents
5.	Double fertilization is absent	Double fertilization is present
6.	Endosperm is haploid	Endosperm is triploid
7.	Fruit formation is absent	Fruit formation is present
8.	Flowers absent	Flowers present

2

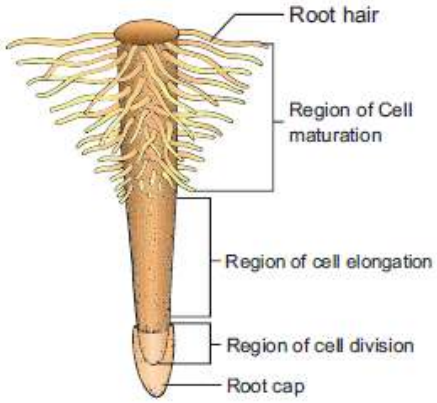
23 **Difference between stem climbers and root climbers**

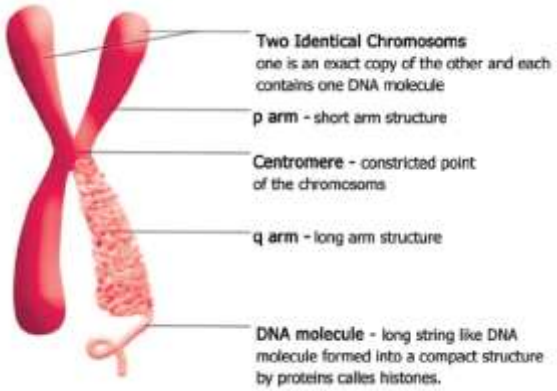
Root Climbers: Plants climbing with the help of adventitious roots are called root climbers. Eg. Piper betel, Piper nigrum, Hedera helix, Pothos, Hoya. **1**

Stem Climbers: These climbers lack specialised structure for climbing and the stem itself coils around the support. Example: Ipomoea, Convolvulus, Dolichos, Clitoria, Quisqualis. **1**

24 **Mangrove trees grow in salt water :**

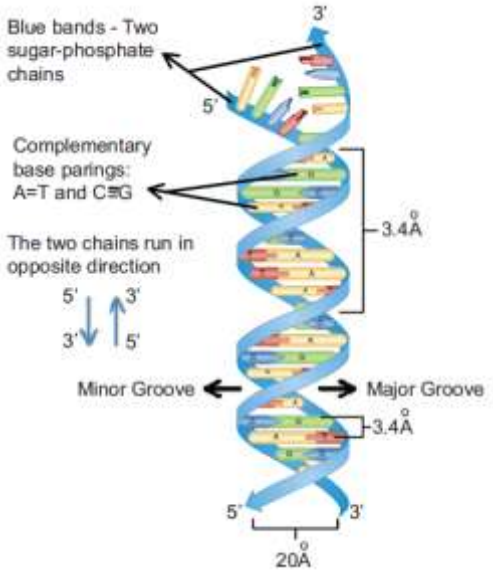
These amazing trees and shrubs cope with salt. Salt water can kill Plants, so mangroves must extract fresh water from the sea water that surrounds them. Many mangrove species survive by filtering out as much as 90 percent of the salt found in seawater as it enters their roots. Mangrove excrete salt through glands in their leaves. **2**

III.	PART-III Answer any six of the following. Question No. 33 is compulsory	6X3=18
25	**Magnetosomes:** Intracellular chains of 40-50 magnetite (Fe_3O_4) particles are found in bacterium *Aquaspirillum magnetotacticum*. and it help the bacterium to locate nutrient rich sediments. **Fimbriae:** Pili or fimbriae are hair like appendages found on surface of cell wall of gram-negative bacteria. Example: *Enterobacterium*.	$1\frac{1}{2}$ $1\frac{1}{2}$
26	**Protostele:** In protostele xylem surrounds phloem. The type includes Haplostele, Actinostele, Plectostele, and Mixed protostele. (i) **Haplostele**: Xylem surrounded by phloem is known as haplostele. Example: *Selaginella.* (ii) **Actinostele**: Star shaped xylem core is surrounded by phloem is known as actinostele. Example: *Lycopodium serratum.* (iii) **Plectostele**: Xylem plates alternates with phloem plates. Example: *Lycopodium clavatum.* (iv) **Mixed prototostele**: Xylem groups uniformly scattered in the phloem. Example: *Lycopodium cernuum*.  Protostele	**3**
27	**Ikebana** Ikebana is a Japanese form of floral art. A creative mind can earn more money in floral art industry. Ikebana is all about flowers arranged in angles. Floral art is not just an arrangement of flowers, but it is also about coordinating colours and texture. Ikebana experts are needed for marriages, other functions and in star hotels.	**3**
28	Region of root diagram:  **Characteristic features of root system: (any two)** ❖ Root is the descending portion of the plant axis. ❖ Generally non-green in colour as it lacks chlorophyll. ❖ Does not possess nodes, internodes and buds (Exception in sweet potato and members of Rutaceae, roots bear buds which help in vegetative propagation) ❖ It bears root hairs (To absorb water and minerals from the soil) ❖ It is positively geotropic and negatively phototrophic in nature.	$1\frac{1}{2}$ $1\frac{1}{2}$

29	**Example for the following metabolisms:** **Amino acid:** Proline, leucine **Organic acid:** Acetic acid, lactic acid **Toxins:** Abrin, ricin **Lectins:** Concanavalin A **Drugs:** Vinblastin, curcumin **Alkaloids:** Morphine, codeine	**3**
30	**Structure of chromosome and label its parts:**  	**DIAGRAM 2** **PARTS - 1**
31	**Role of Nitrosomonas and Nitrobacter during Nitrificaiton process:** Ammonia (NH_3^+) is converted into Nitrite (NO_2^-) by *Nitrosomonas* bacterium. Nitrite is then converted into Nitrate (NO_3^-) by *Nitrobacter* bacterium. Plants are more adapted to absorb nitrate (NO_3-) than ammonium ions from the soil. $2\,NH_3^+ + 3\,O_2 \xrightarrow{Nitrosomonas} 2\,NO_2^- + 2\,H^+ + 2H_2O$ $2\,NO_2^- + O_2 \xrightarrow{Nitrobacter} 2\,NO_3^-$	**2** **1**
32	**Kranz anatomy:** ❖ C_4 plants is the presence of dimorphic chloroplast ❖ *Bundle sheath chloroplast:* Larger chloroplast, thylakoids not arranged in granum and rich in starch. ❖ *Mesophyll Chloroplast:* Smaller chloroplast, thylakoids arranged in granum and less starch.	**3**
33	**Cellular respiration stages are similar in both plants and animals.** ❖ Cellular respiration takes place inside the cell. A specialized respiratory system is present in animals but is absent in plants for delivering oxygen inside the cell. But the cellular respiration stages are similar in both plants and animals which hint at evolutionary divergence. ❖ Plants require carbon dioxide to survive, to produce carbohydrates and to release oxygen through photosynthesis. These oxygen molecules are inhaled by human through the nose, which reaches the lungs where oxygen is transported through the blood and it reaches cells.	**3**
IV.	**PART-IV**	**5X5=25**
34 a	**Technical term of Clitoria ternatea** **Habit:** Twining climber **Root:** Branched tap root system having nodules. **Stem:** Aerial, weak stem and a twiner **Leaf:** Imparipinnately compound, alternate, stipulate showing reticulate venation. Leaflets are stipellate. Petiolate and stipels are pulvinated.	**1**

	Inflorescence: Solitary and axillary **Flower:** Bracteate, bracteolate, bracteoles usually large, pedicellate, heterochlamydeous, complete, bisexual, pentamerous, zygomorphic and hypogynous. **Calyx:** Sepals 5, synsepalous, green showing valvate aestivation. Odd sepal is anterior in position. **Corolla:** Petals 5, white or blue apopetalous, irregular papilionaceous corolla showing, descendingly imbricate aestivation. **Androecium:** Stamens 10, diadelphous (9)+1 nine stamens fused to form a bundle and the tenth stamen is free. Anthers are dithecous, basifixed, introse and dechiscing by longitudinal slits. **Gynoecium:** Monocarpellary, unilocular, with many ovules on mariginal placentation, ovary superior, style simple and incurved with feathery stigma. **Fruit:** Legume **Seed:** Non-endospermous, reniform. **Floral Formula:** $Br.,Brl.,\%,\delta,\varphi,K_{(5)},C_5,A_{(9)+1},\underline{G}_1$  Floral diagram	**2** **1** **1**
b	**Significance of mitosis:** ❖ **Genetic stability** – daughter cells are genetically identical to parent cells. ❖ **Growth** – as multicellular organisms grow, the number of cells making up their tissue increases. The new cells must be identical to the existing ones. ❖ **Repair of tissues** - damaged cells must be replaced by identical new cells by mitosis. ❖ **Asexual reproduction** – asexual reproduction results in offspring that are identical to the parent. Example Yeast and Amoeba. ❖ In flowering plants, structure such as bulbs, corms, tubers, rhizomes and runners are produced by mitotic division. When they separate from the parent, they form a new individual. ❖ The production of large numbers of offsprings in a short period of time, is possible only by mitosis. In genetic engineering and biotechnology, tissues are grown by mitosis (i.e. in tissue culture). ❖ **Regeneration** – Arms of star fish	**1** **1** **1** **1** **1**
35 a	**Structure of DNA:** ❖ Watson and Crick shared the **Nobel Prize** in **1962** for their discovery, along with **Maurice Wilkins**, who had produced the crystallographic data supporting the model. ❖ **Rosalind Franklin** (1920–1958) had earlier produced the first clear crystallographic evidence for a helical structure.	**4**

- **James Watson** and **Francis Crick** (Figure 8.40) of Cavendish laboratory in Cambridge built a scale model of double helical structure of DNA which is the most prevalent form of DNA, the **B-DNA**. This is the secondary structure of DNA.
- As proposed by **James Watson and Francis Crick**, DNA consists of right handed double helix with 2 helical polynucleotide chains that are coiled around a common axis to form right handed B form of DNA.
- The coils are held together by hydrogen bonds which occur between complementary pairs of nitrogenous bases. The sugar is called **2′-deoxyribose** because there is no hydroxyl at position 2′.
- Adenine and thiamine base pairs has two hydrogen bonds while guanine and cytosine base pairs have three hydrogen bonds.
- As published by **Erwin Chargaff** in 1949, a purine pairs with pyrimidine and vice versa**.**
- Adenine (A) always pairs with Thymine (T) by double bond and Guanine (G) always pairs with Cytosine (C) by triple bond.



1

b. **Differences Between Secondary Growth in Dicot Stem and Root**

Secondary growth in dicot stem	Secondary growth in dicot root	
The cambial ring formed is circular in cross section from the beginning.	The cambial ring formed is wavy in the beginning and later becomes circular.	**1**
The cambial ring is partially primary (fascicular cambium) and partially secondary (Interfascicular cambium) in origin.	The cambial ring is completely secondary in origin.	**1**
Generally, periderm originates from the cortical cells (extra stelar in origin).	Generally, periderm originates from the pericyle. (intrastealar in origin)	**1**
More amount of cork is produced as stem is above ground	Generally, less amount of cork is produced as root is underground.	**1**
Lenticels of periderm are prominent.	Lenticels of periderm are not very prominent.	**1**

36 a — **5 (ANY FIVE)**

Physiological effect of cytokinin:

- Cytokinin promotes cell division in the presence of auxin (IAA).
- Induces cell enlargement associated with IAA and gibberellins
- Cytokinin can break the dormancy of certain light-sensitive seeds like tobacco and induces seed germination.
- Cytokinin promotes the growth of lateral bud in the presence of apical bud.
- Application of cytokinin delays the process of aging by nutrient mobilization. It is known as **Richmond Lang effect**.
- Cytokinin (i) increases rate protein synthesis (ii) induces the formation of inter-fascicular cambium (iii) overcomes apical dominance (iv) induces formation of new leaves, chloroplast and lateral shoots.
- Plants accumulate solutes very actively with the help of cytokinins.

b

Plasmolysis: — **3**

Plasmolysis (*Plasma* = cytoplasm; *lysis* = breakdown). When a plant cell is kept in a hypertonic solution, water leaves the cell due to **exosmosis**. As a result of water loss, protoplasm shrinks and the cell membrane is pulled away from the cell wall and finally, the cell becomes **flaccid**. This process is named as **plasmolysis**. Wilting of plants noticed under the condition of water scarcity is an indication of plasmolysis. Three types of plasmolysis occur in plants: — **2**

Significance: Plasmolysis is exhibited only by living cells and so it is used to test whether the cell is living or dead.

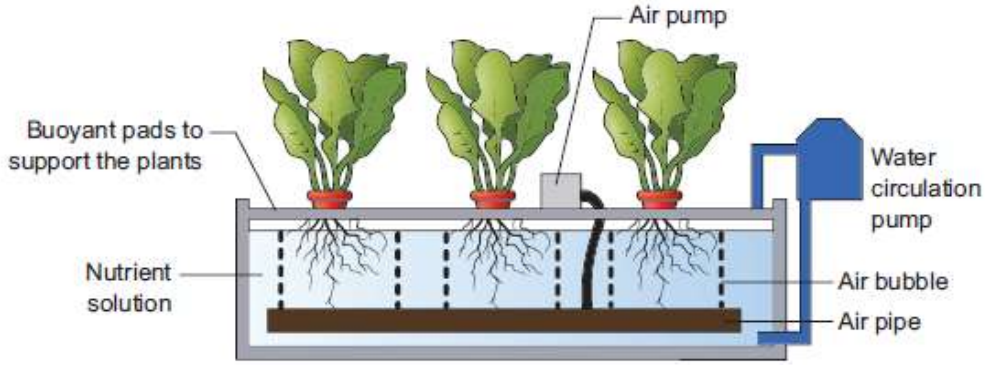
37 a — **ANY 5**

C3 Plants	C4 Plants	
CO_2 fixation takes place in mesophyll cells only	CO_2 fixation takes place mesophyll and bundle sheath	
CO_2 acceptor is RUBP only	PEP in mesophyll and RUBP in bundle sheath cells	**1**
First product is 3C- PGA	First product is 4C- OAA	
Kranz anatomy is not present	Kranz anatomy is present	
Granum is present in mesophyll cells	Granum present in mesophyll cells and absent in bundle sheath	**1**
Normal Chloroplast	Dimorphic chloroplast	
Optimum temperature 20° to 25°C	Optimum temperature 30° to 45°C	
Fixation of CO_2 at 50 ppm	Fixation of CO_2 even less than 10 ppm	
Less efficient due to higher photorespiration	More efficient due to less photorespiration	**1**
RUBP carboxylase enzyme used for fixation	PEP carboxylase and RUBP carboxylase used	
18 ATPs used to synthesize one glucose	Consumes 30 ATPs to produce one glucose.	**1**
Efficient at low CO_2	Efficient at higher CO_2	
Example: Paddy, Wheat, Potato and so on	Example: Sugar cane, Maize, *Sorghum*, *Amaranthus* and so on	**1**

b

Hydroponics: — **5**

Von Sachs developed a method of growing plants in nutrient solution. The commonly used nutrient solutions are **Knop solution** (1865) and **Arnon** and **Hoagland Solution** (1940). Later the term Hydroponics was coined by **Goerick** (1940) and he also introduced commercial techniques for hydroponics. In hydroponics roots are immersed in the solution containing nutrients and air is supplied with help of tube



38 a **Anatomy of a Dicot Leaf-sunflower Leaf**

Internal structure of dictoyledonous leaves reveal epidermis, Mesophyll and vascular tissues.

Epidermis

This leaf is generally **dorsiventral.** It has upper and lower epidermis. The epidermis is usually made up of a single layer of cells that are closely packed. The cuticle on the upper epidermis is thicker than that of lower epidermis. The minute openings found on the epidermis are called **stomata**. Stomata are more in number on the lower epidermis than on the upper epidermis. A stomata is surrounded by a pair of **bean shaped** cells called guard cells. **1**

Each stoma internally opens into an air chamber. These guard cells contain chloroplasts, whereas other epidermal cells do not contain chloroplasts. The main function of the epidermis is to give protection to the inner tissue called **mesosphyll**. The cuticle helps to check transpiration. Stomata are used for transpiration and gas exchange.

Mesophyll

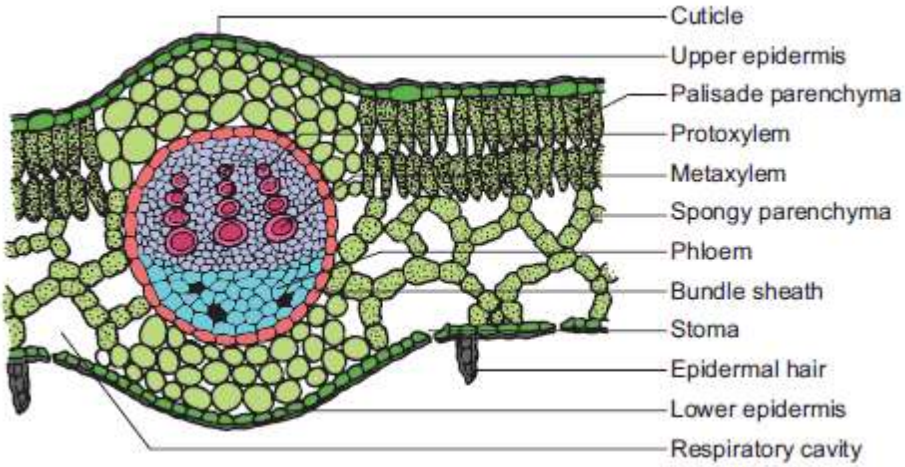
The entire tissue between the upper and lower epidermis is called the **mesophyll (GK meso = in the middle, phyllome = leaf).** There are two regions in the mesophyll. They are **palisade parenchyma and spongy parenchyma.** Palisade parenchyma cells are seen beneath the upper epidermis. It consists of vertically elongated cylindrical cells in one or more layers. These cells are compactly arranged and are generally without intercellular spaces. Palisade parenchyma cells contain more chloroplasts than the spongy parenchyma cells. The function of palisade parenchyma is **photosynthesis.**

Spongy parenchyma lies below the palisade parenchyma. Spongy cells are irregularly shaped. These cells are very loosely arranged with numerous airspaces. As compared to palisade cells, the spongy cells contain lesser number of chloroplasts. Spongy cells facilitate the **exchange of gases** with the help of air spaces. The air space that is found next to the stomata is called **respiratory cavity or substomatal cavity**. **1**

Vascular Tissues

Vascular tissues are present in the veins of leaf. Vascular bundles are **conjoint, Collateral and closed.** Xylem is present towards the upper epidermis, while the phloem towards the lower epidermis. Vascular bundles are surrounded by a compact layer of parenchymatous cells called **bundle sheath or border parenchyma**.

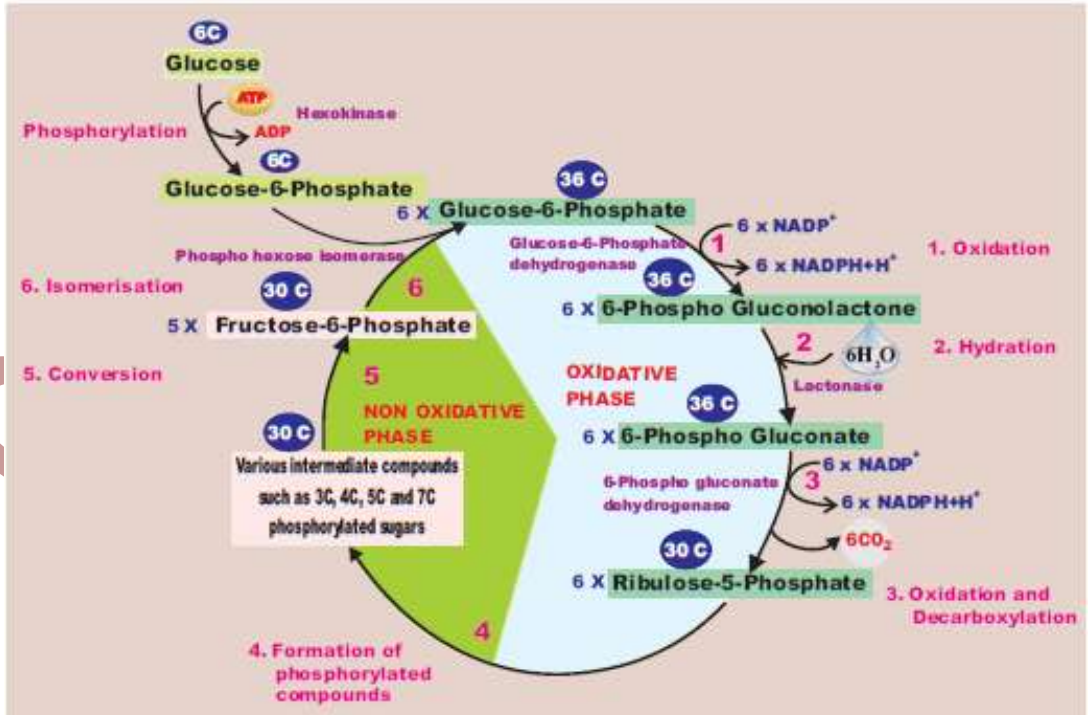
Xylem consists of metaxylem and protoxylem elements. Protoxylem is present towards the upper epidermis,while the phloem consists of sieve tubes, companion cells and phloem parenchyma. Phloem fibres are absent. Xylem consists of vessels and xylem parenchyma. Tracheids and xylem fibres are absent. **1**



1+1

b Pentose Phosphate Pathway is a alternate way of glucose breakdown. It is also known as **Hexose monophosphate shunt (HMP Shunt)** or **Direct Oxidative Pathway**. It consists of two phases, oxidative phase and non-oxidative phase. The oxidative events convert six molecules of six carbon Glucose-6-phosphate to 6 molecules of five carbon sugar Ribulose-5 phosphate with loss of $6CO_2$ molecules and generation of 12 NADPH + H^+ (not NADH). The remaining reactions known as **non-oxidative pathway**, convert Ribulose-5-phosphate molecules to various intermediates such as Ribose-5-phosphate(5C), Xylulose-5-phosphate(5C), Glycera ldehyde-3-phosphate(3C), Sedoheptulose-7-Phosphate(7C), and Erythrose-4-phosphate(4C). Finally, five molecules of glucose-6-phosphate is regenerated. The overall reaction is:

1



4

$$6 \text{ x Glucose-6-Phosphate} + 12NADP^+ + 6H_2O \rightarrow 5 \text{ x Glucose-6-Phosphate} + 6CO_2 + Pi + 12NADPH + 12H^+$$