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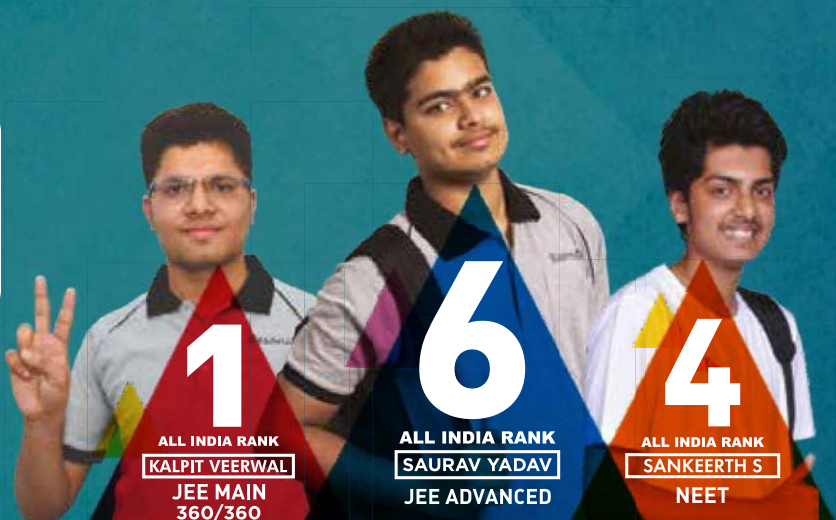
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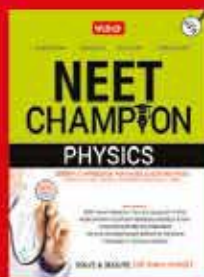
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Managing Editor : Mahabir Singh
Editor : Anil Ahlawat

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HIGH YIELD FACTS



Class XI

MORPHOLOGY OF FLOWERING PLANTS - I

- Morphology deals with the study of form, size, colour, structure and relative positions of various parts of organisms. It indicates the structural adaptations of organisms to their environment.
- As we know, flowering plants or angiosperms are the most advanced and abundant of all the plants and show great diversity in their form, size, life span, habit, etc. Hence, knowledge of morphology is essential for recognition or identification of plants.
- Before proceeding with the possible variations and adaptations of different parts of plant, let us have a look at types of plant on the basis of their habit, life span, habitat, nutrition, etc.

CLASSIFICATION OF PLANTS

Herbs

- Small plants with soft, delicate and green stems normally growing to a height of less than 2 m.
- These may be annuals (e.g., mustard, pea, rice, etc.), biennials (e.g., beet, carrot, etc.) or perennials (e.g., ginger, banana, etc.).

Trees

- Tall plants with a thick woody main stem called trunk.
- The trunk may remain unbranched (caudex), produce narrow lateral branches (excurrent) or disappear after some distance so that the crown appears dome shaped (deliquescent).
- These are perennials, e.g., *Mangifera indica*, *Dalbergia*, etc.

On the basis of habit

(Based on height, duration and nature of stem)

Mainly of three types

Shrubs

- These are usually taller than herbs, measuring 1-3 m in height and have woody stems.
- These branch profusely from near the ground and thus, become bushy in habit without a clear trunk.
- These are perennials, e.g., *Hibiscus rosa-sinensis*, *Capparis*, etc.

Analysis of various PMTs from 2013-2017

	2013	2014	2015	2016	2017
AIPMT/NEET	3	5	5	9	3
AIIMS	1	1	1	3	1
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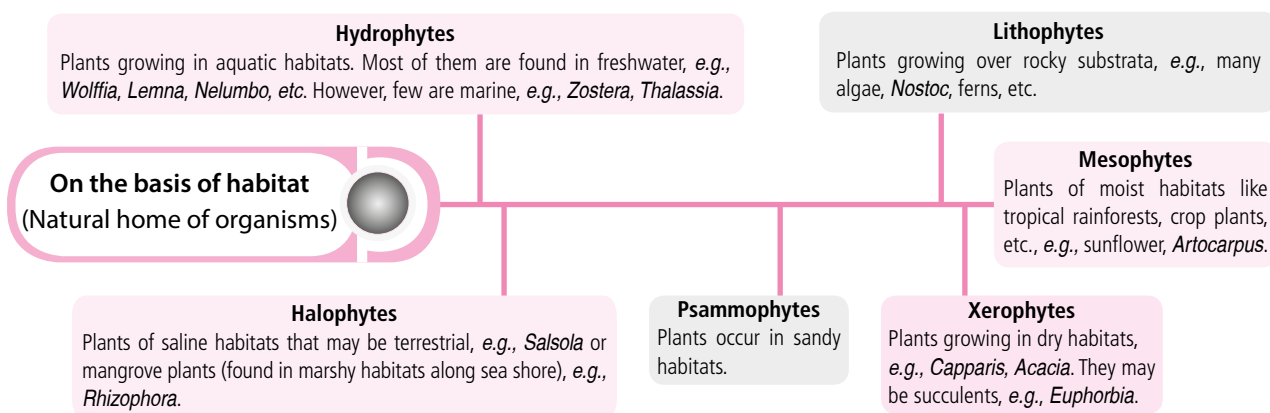
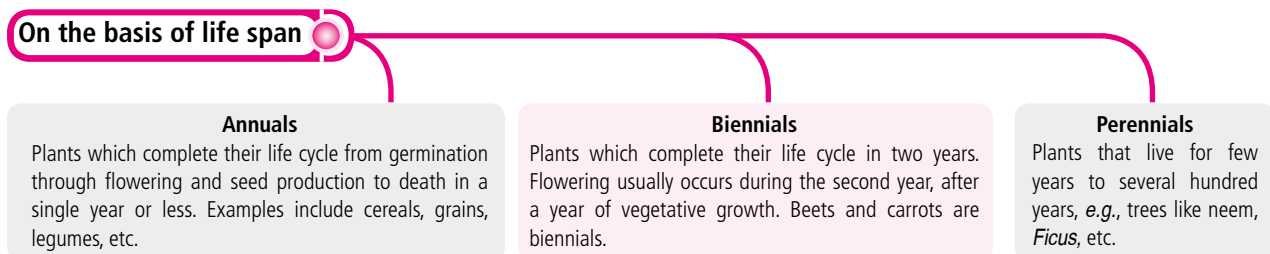
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PARTS OF A FLOWERING PLANT

- Plant axis is differentiated into above ground shoot system and underground root system. The different structures borne on the plant axis are called organs. There are two types of plant organs, vegetative and reproductive. Root, stem and leaves are vegetative organs while flowers, fruits and seeds are reproductive organs.

MORPHOLOGY OF ROOT

- The root is typically a non-green underground descending portion of the plant axis which gives rise to similar types of endogenous lateral branches and does not possess nodes and internodes. It is positively geotropic, positively hydrotropic and negatively phototropic.

Parts of Root

- A typical root possesses following parts:

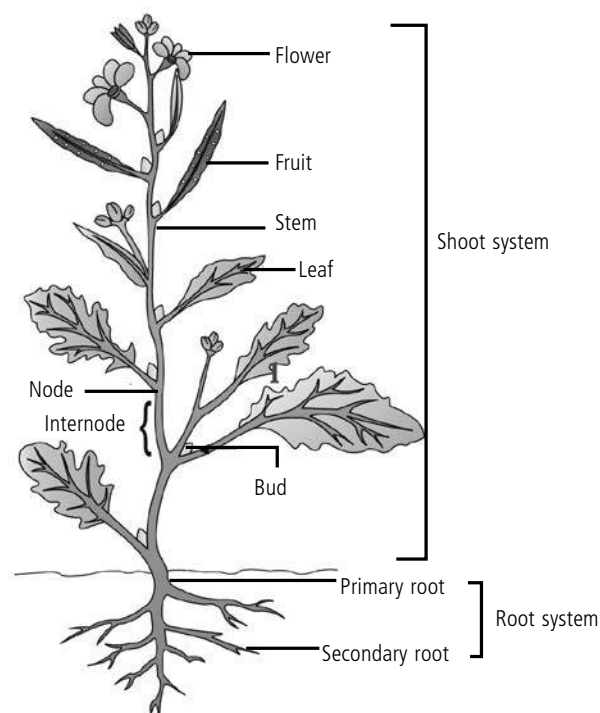


Fig.: Parts of a flowering plant



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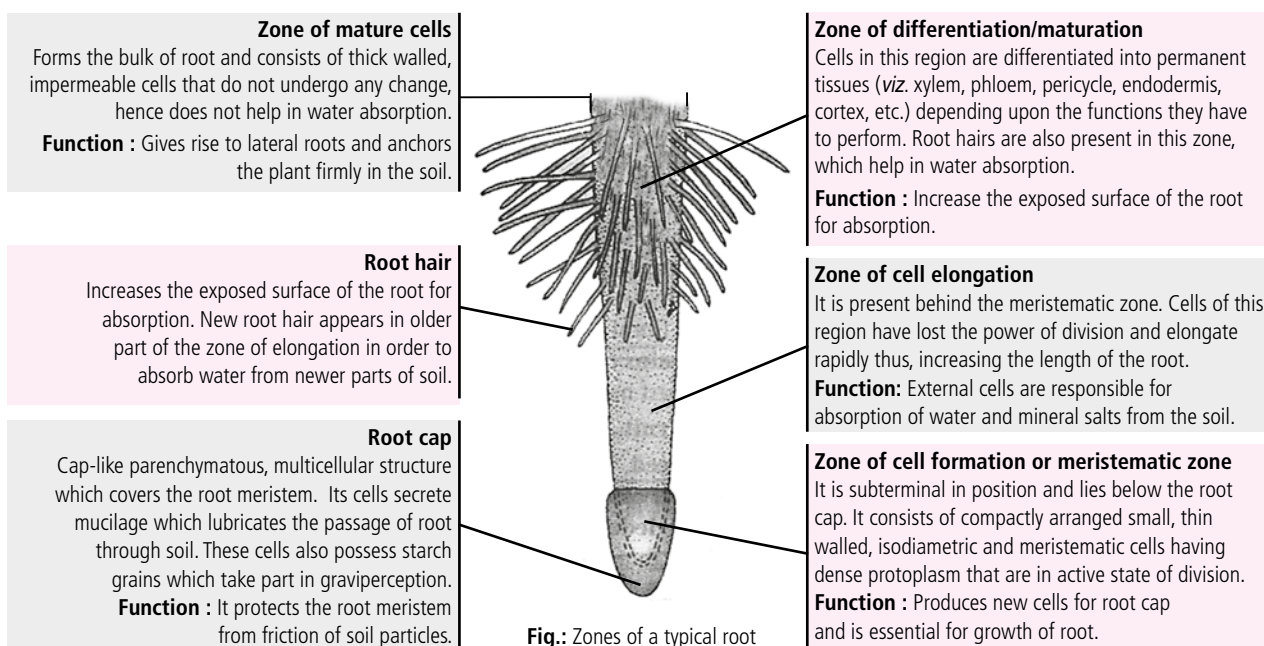
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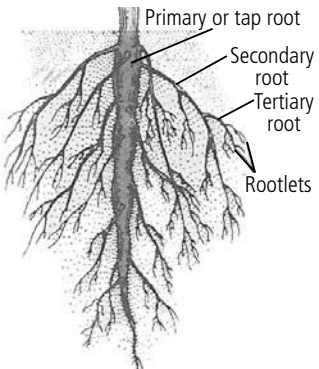
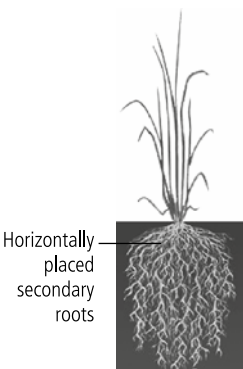
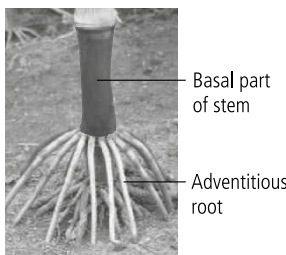
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Types of Root System

- There are three types of root system occurring in plants, *i.e.*, tap root system, fibrous root system and adventitious root system.

Table: Comparison between different types of root system

	Tap root system	Fibrous root system	Adventitious root system
(i)	It is formed from the radicle of the embryo.	It occurs in place of tap root system at the base of main stem.	It may develop from any part of the plant other than radicle or its branches.
(ii)	It is always underground.	It is always underground.	It may be underground or aerial.
(iii)	It consists of a single primary (main) root.	Primary root is short lived. Instead underground roots arise in groups from base of stem.	Primary root is absent and it consists of roots forming a cluster.
(iv)	Primary root produces distinct secondary roots, tertiary roots and rootlets in acropetal succession.	The main roots are of equal lengths and give off small branches. Main roots and their branches are thin and thread like.	The roots may be thick, thin or variously modified.
(v)	It may be surface or deep feeder, the deep feeder being the usual feature.	It is usually surface feeder.	It is usually surface feeder.
(vi)	It is commonly found in dicots.	It is commonly found in monocots.	It is found both in dicots and monocots.
	 <p>Fig.: Tap root system</p>	 <p>Fig.: Fibrous root system</p>	 <p>Fig.: Adventitious root system</p>

Modifications of Roots

- Roots are primarily meant for anchorage of plant and absorption of water and minerals from soil for their transport to the shoot system. However, roots undergo morphological modifications to perform various functions such as food storage, mechanical support, etc.
- Both tap roots and adventitious roots are variously modified to serve different functions.

Functions of roots

Anchorage

Roots take part in fixation of plant and supports the shoot system.

Absorption of water and minerals

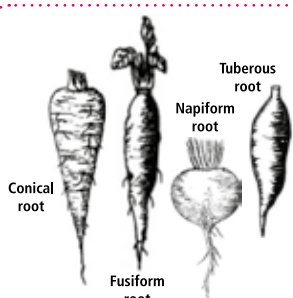
Roots absorb water and minerals from soil.

Prevention of soil erosion

Roots hold the soil particles firmly to prevent soil erosion.

Transport

Roots transport the absorbed water and minerals to aerial or shoot system.



Fleshy tap roots

Tap roots become swollen and fleshy with stored food. Depending upon shape, these are of following types:

Conical : Thicker on the upper end and tapering at the lower end, e.g., *Daucus carota* (carrot).

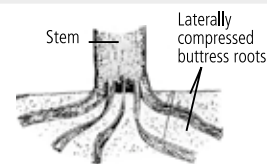
Tuberous : Swollen and without any definite shape, e.g., *Mirabilis*.

Napiform : Much swollen and spherical at the upper end and taper downward into a thread like structure, e.g., *Brassica rapa* (turnip).

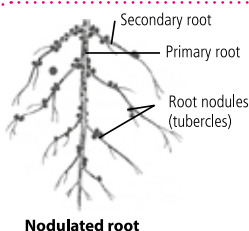
Fusiform : Swollen in the middle and tapering on both ends, e.g., *Raphanus sativus* (radish).

Buttress roots

They are horizontal roots that arise jointly from the bases of tap root and the trunk. They provide extra support, e.g., peepal.

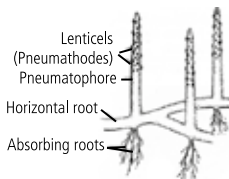


Modifications of tap root



Nodulated (Tuberculate)

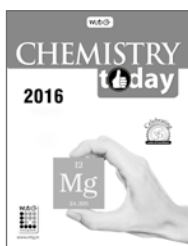
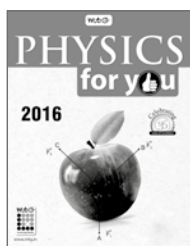
Root nodules (small or large irregular swellings) are present on the roots and their branches that enclose millions of N_2 fixing bacteria which help to perform biological N_2 -fixation, e.g., leguminous plants.



Pneumatophores (Respiratory roots)

Upright breathing aerial roots which develop at short intervals, found in plants growing in mangroves or saline swamps, near the seashore, e.g., *Avicennia*. These roots pick up oxygen for perspiration of roots and give out excess of CO_2 . These bear lenticels near their tips, while their remaining surface is covered by cork.

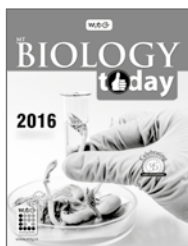
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Modifications of adventitious root

For storage of food

Tuberous roots
These roots arise from nodes of stem and become tuberous and fleshy for storage of food, e.g., *Ipomoea*.



Tuberous root

Fasciculated roots
Tuberous roots in clusters, e.g., *Dahlia*, *Asparagus*.



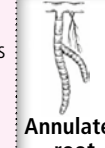
Fasciculated root

Palmate roots
The fleshy roots are thickened like human palm and possess finger like outgrowths, e.g., *Orchis*.



Palmate root

Annulated roots
Ring like outgrowths or swellings occur at regular intervals, e.g., *Psychotria*.



Annulated root

Nodulose roots
Swollen at tips, e.g., *Curcuma amada*.



Nodulose root

Moniliform roots
Swollen at regular intervals, e.g., *Momordica*.



Moniliform root

For mechanical support

Prop roots

These are thick pillar-like roots which grow vertically downwards from horizontal stem branches, e.g., *Ficus benghalensis*.



Prop root

Stilt roots

The roots develop obliquely from basal nodes of stem, e.g., maize, *Sorghum*, screw pine, etc.



Stilt root

Climbing or Clinging roots

These are non-absorptive roots found in climbers. They may arise from nodes or internodes or both. They attach to their support firmly by forming claws, swollen disc, etc., e.g., *Hedera*, *Pothos* etc.



Climbing root



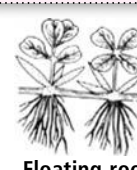
Hauatoria root

Hauatoria or sucking roots

They are parasitic and absorb nourishment from host plant, e.g., *Cuscuta*.

Floating roots

These roots store air, become inflated and help the plant to float on water surface. They also help in gaseous exchange (respiratory in function), e.g., *Jussiaea*.



Floating root

Epiphytic roots

Thick, irregular roots which hang down in air. They do not have root cap and root hair but possess a covering of dead spongy tissue known as velamen that absorbs water from moist atmosphere, e.g., *Vanda*.



Epiphytic root

Assimilatory roots

Green photosynthetic roots develop from stem nodes and become highly branched to increase photosynthetic area, e.g., *Trapa*.



Assimilatory root

Reproductive roots

Adventitious roots develop buds that grow into new plants under favourable conditions, e.g., *Dahlia*.



Reproductive root

For vital functions

Rootless plants

Not all flowering plants possess roots as an essential part. Many aquatic plants do not have roots as there is little requirement for absorption of water and mineral salts, e.g., *Wolffia*, *Utricularia*, *Ceratophyllum*.

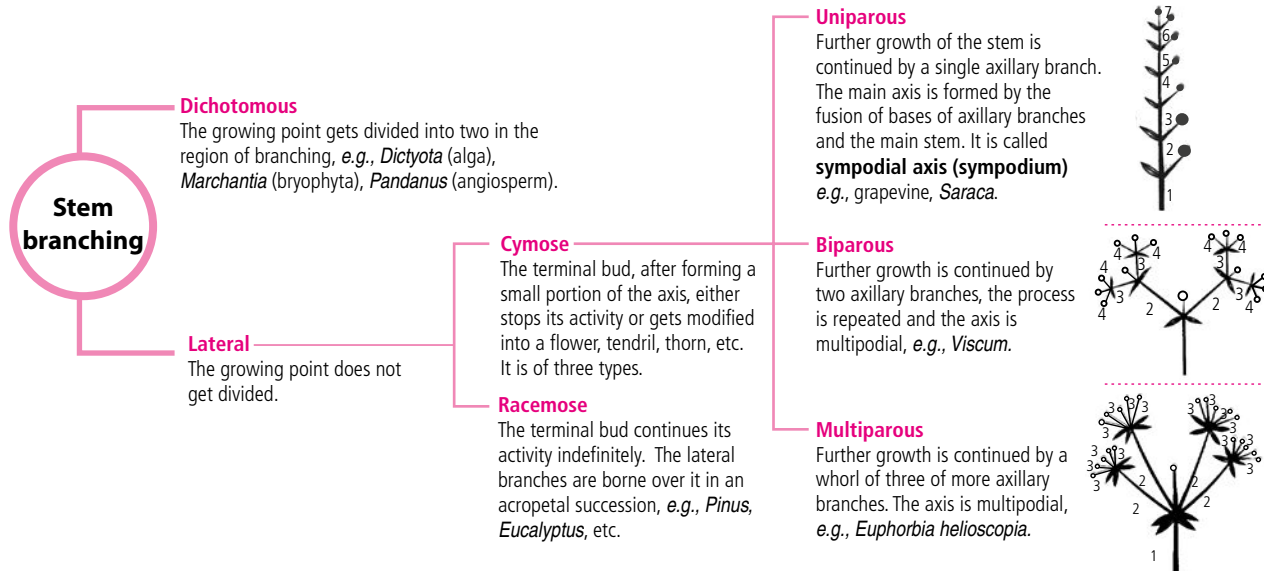
However, some aquatic plants develop roots for balancing as in *Lemna*, *Pistia* or for fixation as in *Hydrilla*.

MORPHOLOGY OF STEM

- Stem is an ascending part of the plant body that develops from the plumule of the embryo and is usually negatively geotropic and positively phototropic.

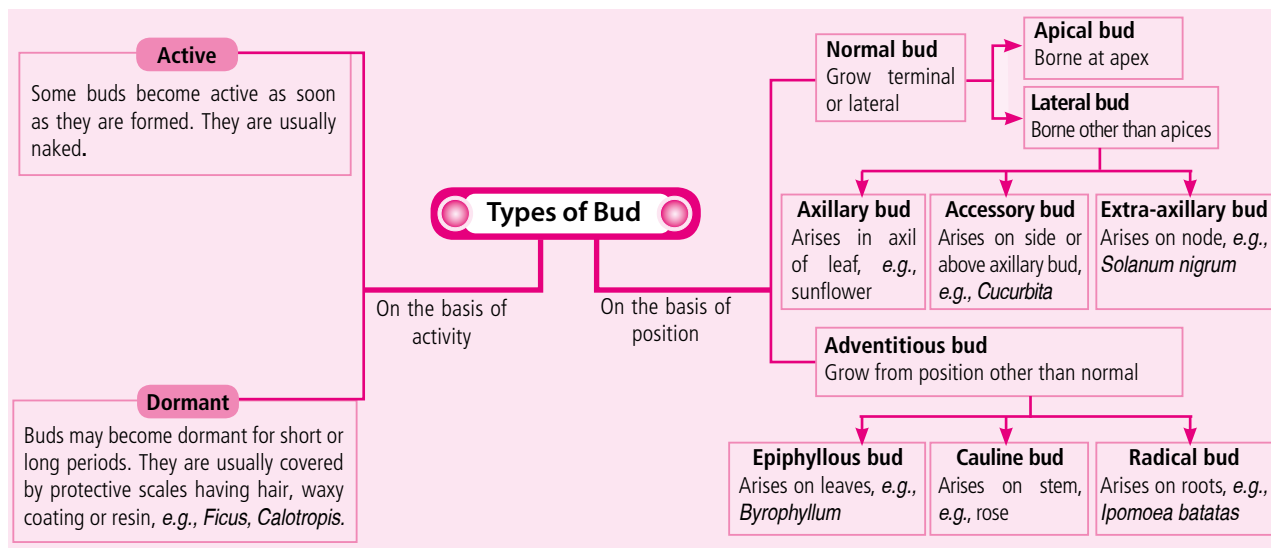
Branching Patterns of Stem

- The unbranched stem is called caudex or columnar, e.g., palm, sugarcane, maize.
- Branching in stem may be of two types:



Buds

- Stem grows by means of a terminal bud which represents a condensed immature or embryonic shoot possessing a growing point. The buds are generally small in size. The largest bud is that of cabbage. According to their nature/structure, buds can be **vegetative** (form leafy shoots only), **floral** (reproductive buds that develop into flowers) or **mixed** (both vegetative and floral branches).



Diverse Forms of Stem

- Stem may be aerial, sub-aerial or underground. These are variously modified to perform different functions such as storage of food, vegetative propagation, mechanical support, protection, etc.

Aerial stem

- Aerial stems are usually upright and may be erect or weak.

Reduced

- Stem is reduced to small disc.
- Nodes and internodes are not distinguishable.
- They are modified as per the need of plants, such as
 - Reduced green discoid stem is present above the base of root, with leaves crowded together on it (radical leaves), *e.g.*, carrot, turnip, etc.
 - Reduced discoid stem may be green and flattened to float on water surface, *e.g.*, *Wolffia*, *Lemna*.

Erect

- Common type of aerial stem. Sufficiently strong to remain erect or upright without any external support, *e.g.*, maize, mango.

Culms

Erect stems with swollen nodes or jointed stems, *e.g.*, bamboo.

Caudex

It is unbranched erect stem.

Branched

Branched erect stems may be either excurrent or deliquescent.

Weak

- Such stems are thin, soft and cannot stand erect, therefore, require a support.
- These stems are broadly of two types.

Upright**Twiners**

- Long, slender, flexible and sensitive stem. Coils around an upright support like a rope, *e.g.*, *Lablab*, *Ipomoea*.

Climbers

- Weak and flexible stem that are unable to coil around an upright support by itself, but requires certain clasping structures.

Root climbers

Stem clings to the support by adventitious roots, *e.g.*, ivy, betel.

Tendrils climbers

Green thread like sensitive structures called tendrils that coil around support and help weak shoots to climb up, *e.g.*, *Passiflora*, *Antigonon*.

Scramblers

Stems are able to rise up a support by clinging to it with the help of curved thorns, *e.g.*, *Bougainvillea*, leaflet hooks, *e.g.*, *Doxantha*, etc.

Lianas

Woody twiners or climbers, *e.g.*, *Phanera vahlii*.

Prostrate (sub-aerial)

Weak stem, require support of ground for spreading and proper exposure of leaves and reproductive organs.

Procumbent

Branches flat on ground, *e.g.*, *Tribulus*.

Decumbent

Some branches are partially vertical, *e.g.*, *Tridax*.

Diffused

Branches spread in all directions, *e.g.*, *Boerhaavia*.

Trailers

- The shoots trail or spread horizontally along the ground without rooting at intervals, *e.g.*, *Convolvulus*, *Euphorbia*.

Creepers

- The shoots spread along the ground and root at intervals. They also help in vegetative propagation.

Runners

- Develops at the base of erect shoot called crown and grows horizontally on the surface of soil.
- Each runner has one or more nodes which bear scale leaves and axillary buds. *E.g.*, *Cynodon dactylon*

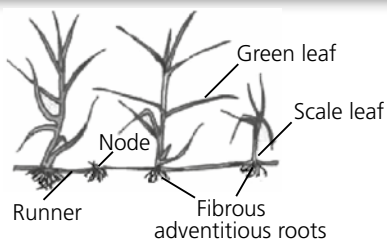


Fig.: Runner of grass

Stolon

- Horizontal or arched runner which can cross over small obstacles.
- Each stolon has one or more nodes possessing scale leaves and axillary buds.
- It possesses comparatively longer internodes. *E.g.*, *Fragaria*.

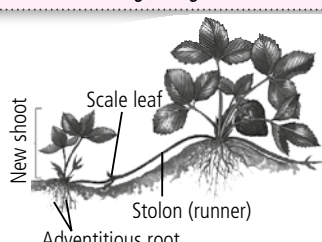


Fig.: Stolon of *Fragaria*

Offset

- One internode long, small runners usually found in rosette plants at the ground or water level. *E.g.*, *Eichhornia*.

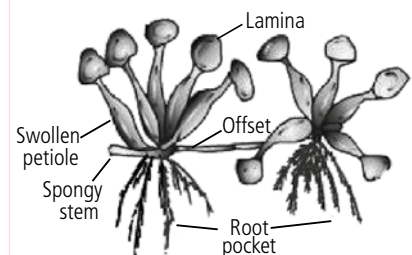


Fig.: Offset of *Eichhornia*

Modifications of Aerial Stem

- Aerial stem modifications can be recognised by their
 - axillary position
 - exogenous origin
 - occurrence of occasional branching
 - differentiation of nodes
 - formation of flowers
 - presence of leaves or buds
 - internal structure

Stem tendrils

- Tendrils are thread-like sensitive structures which can coil around a support and help the plant in climbing. They may be branched or unbranched. Stem tendrils may be **axillary**, (e.g., *Passiflora*), **extra-axillary**, (e.g., *Cucurbita*, *Luffa*), **leaf opposed**, (e.g., grapevine), etc.

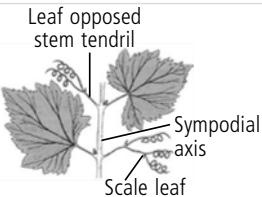


Fig.: Stem tendril of grape vine

Stem thorns

- They are stiff, sharp structures which have lost their growing point and become hard. Thorns not only reduce transpiration but also check browsing by animals. E.g., axillary stem thorns occur in *Citrus*, *Bougainvillea*, etc.

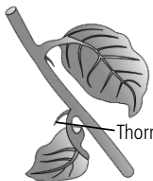


Fig.: Stem thorn

Thalamus

- Flower is a specialised reproductive shoot which possesses a highly condensed axis called thalamus or torus. Thalamus bears four types of floral organs (sepals, petals, stamens and carpels), each from their own nodes.

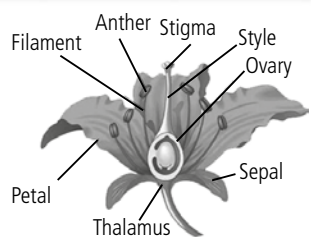


Fig.: Thalamus of flower

Aerial stem modifications

Cladodes

- They are green stems of limited growth (usually one internode long) which have taken over the function of photosynthesis from the leaves. The true leaves are reduced to scales or spines, e.g., *Ruscus aculeatus*, *Asparagus*, etc.




Fig.: Cladode of *Ruscus*

Phylloclades

- Plants growing in dry and xerophytic conditions have modified green stems of unlimited growth called as phylloclades which reduce the transpiration. E.g., *Opuntia*, *Euphorbia royleana*, etc.

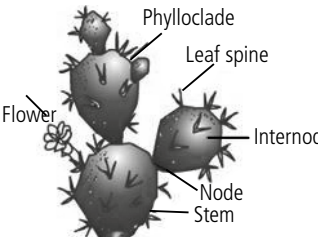


Fig.: Phylloclades of *Opuntia*

Modifications of Underground Stem

- The underground or subterranean stem lies below the surface of soil and is non-green. It bears buds and roots as well as aerial shoots or leaves at intervals during favourable seasons. It stores food and takes part in vegetative propagation of plants.

Differentiation between underground stem and roots

Despite being non-green and underground, the underground stem can be differentiated from roots by presence of following characteristics:

- Absence of root cap and root hair
- Presence of terminal bud
- Presence of nodes and internodes
- Occurrence of foliage or scale leaves and axillary buds on nodes
- Exogenous branching

Bulb is an underground pyriform-spherical modified shoot having highly reduced convex or slightly conical disc-shaped stem and several fleshy scales enclosing a terminal bud. Bulbs are of two types:

- (a) **Tunicated bulb** consists of concentric layers of fleshy scales surrounding the reduced stem having terminal bud. The outermost few scales of the bulb become dry and membranous forming a protective covering called tunic. These bulbs are of two types- (i) **Simple** tunicated bulbs, e.g., *Allium cepa* (onion) and (ii) **Compound** tunicated bulbs, e.g., *Allium sativum* (garlic).
(b) **Scaly**: A tunic or covering sheath is absent. The fleshy scales are narrow and overlap one another on margins only, e.g., lily.

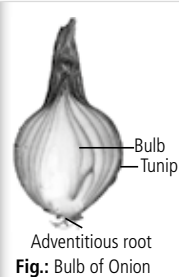


Fig.: Bulb of Onion

Corm is a short, thick, swollen, usually unbranched, spherical or subspherical underground stem which grows vertically in the soil and is formed annually. e.g., *Amorphophallus*, *Colocasia*.

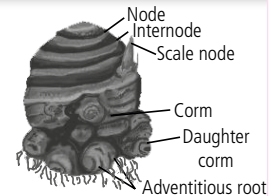


Fig.: Corm of *Amorphophallus*

Sucker is a special non-green slender stem branch which arises from the underground base of an erect shoot and grows horizontally in the soil and ultimately comes out to form a new aerial shoot. E.g., *Chrysanthemum*, mint.

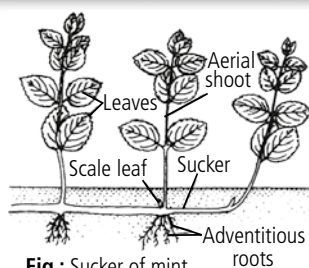


Fig.: Sucker of mint

Rhizome is a perennial fleshy underground stem which continues its growth indefinitely in the soil producing new leaves or aerial shoots during the favourable season and perennation during the unfavourable season, e.g., *Dryopteris*.

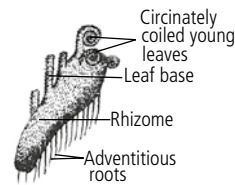


Fig.: Rootstock rhizome of *Dryopteris*

Tuber is an oval or spherical underground swollen structure that does not bear adventitious roots, e.g., potato (*Solanum tuberosum*).

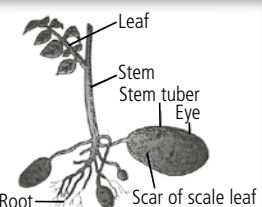


Fig.: Tubers of potato

Underground stem modifications

Primary functions

Functions of stem

Secondary (or accessory) functions

Bears leaves and holds them in such a position so as to provide maximum sunlight.

Conducts water and mineral nutrients from the roots to the leaves, flowers and fruits.

Conducts organic food from the leaves to the roots and storage organs.

Holds flowers in such a position so as to facilitate pollination and fertilisation.

Storage of food, e.g., rhizome of ginger, tuber of potato, etc.

Synthesis of food, e.g., phylloclade of *Opuntia*, cladode of *Ruscus*, etc.

Perennation and vegetative propagation, e.g., corm of *Colocasia*, rhizome of ginger, etc.

Protection, e.g., thorns of *Duranta*, *Bougainvillea*, etc.

Support, e.g., tendrils of grapevine, hooks of *Artabotrys*, etc.

MORPHOLOGY OF LEAF

- Leaf is a green, exogenous lateral flattened outgrowth borne on the node of a stem or branch and is specialised to perform photosynthesis.

ANSWERS

WHO AM I ...

1. Cladode	Pg. 22
2. Umbel	Pg. 27
3. Founder effect	Pg. 63
4. <i>Dryopithecus africanus</i>	Pg. 67

MPP-9 CLASS XI

ANSWER

KEY

1. (b)	2. (d)	3. (d)	4. (b)	5. (d)
6. (a)	7. (b)	8. (a)	9. (c)	10. (d)
11. (a)	12. (b)	13. (c)	14. (a)	15. (d)
16. (b)	17. (b)	18. (c)	19. (c)	20. (a)
21. (b)	22. (b)	23. (a)	24. (c)	25. (a)
26. (c)	27. (d)	28. (d)	29. (a)	30. (c)
31. (c)	32. (c)	33. (c)	34. (d)	35. (d)
36. (a)	37. (b)	38. (c)	39. (d)	40. (c)

Parts of a Typical Leaf

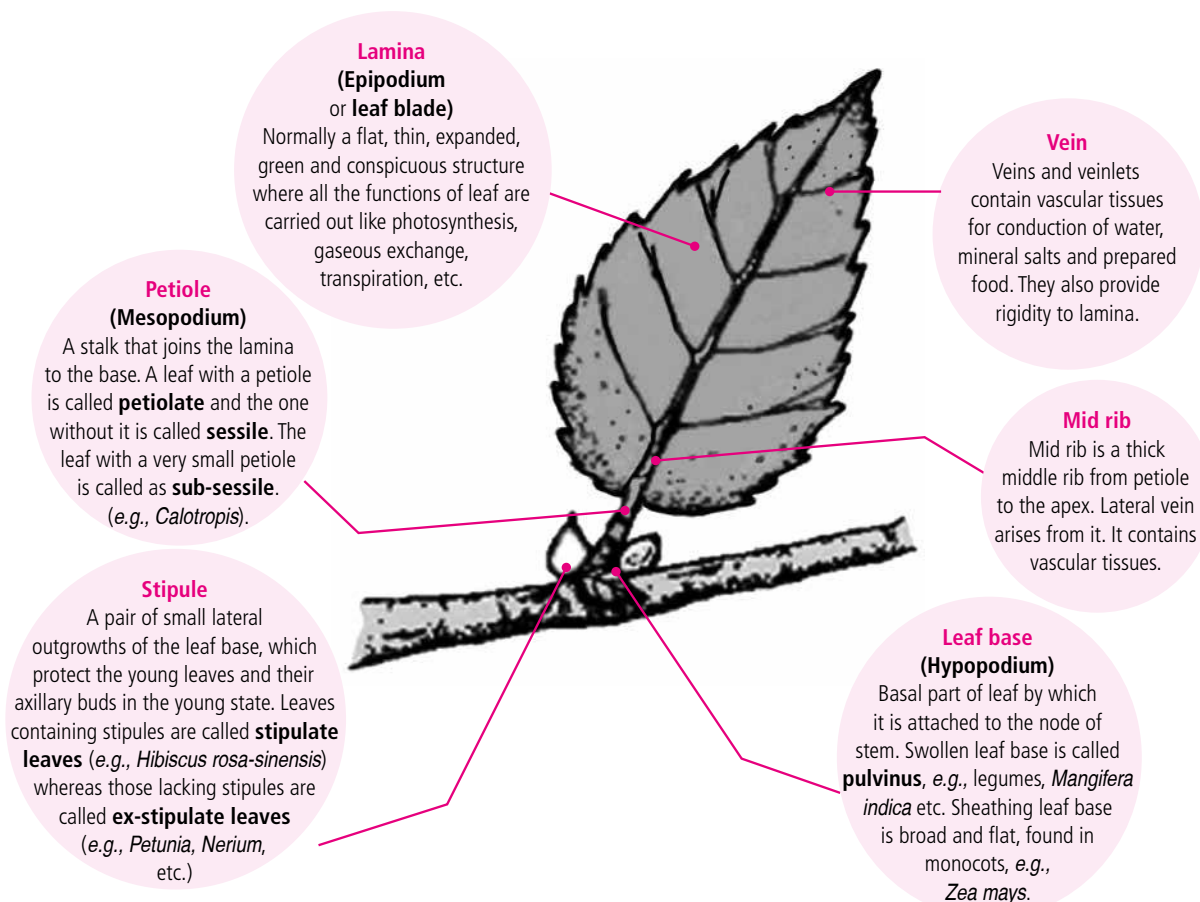
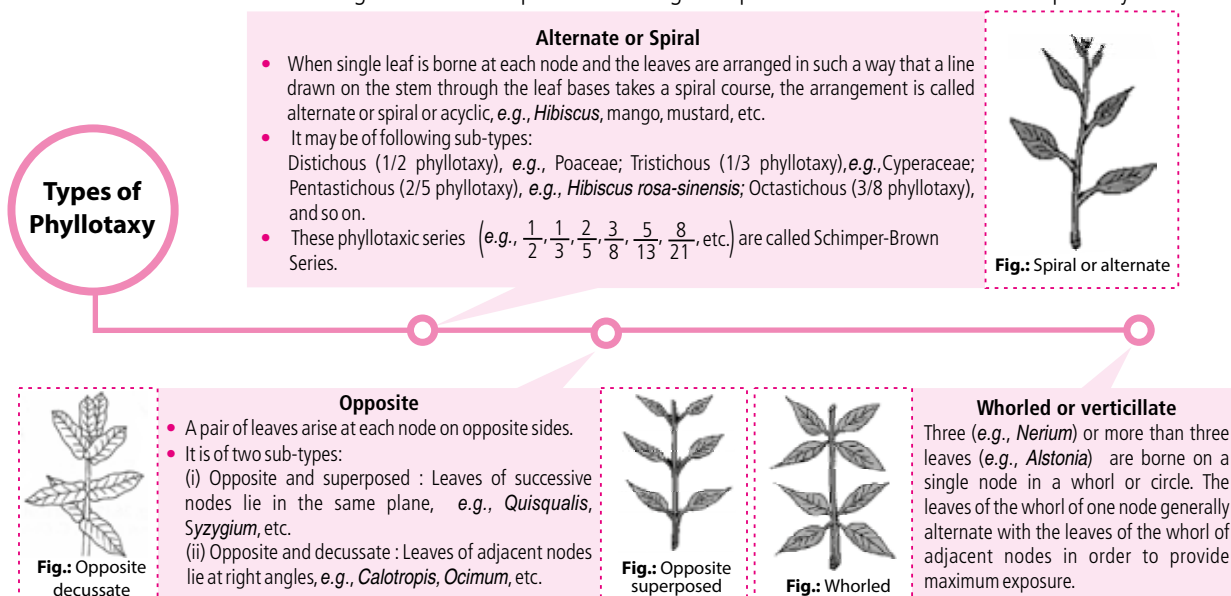


Fig: Parts of a typical leaf

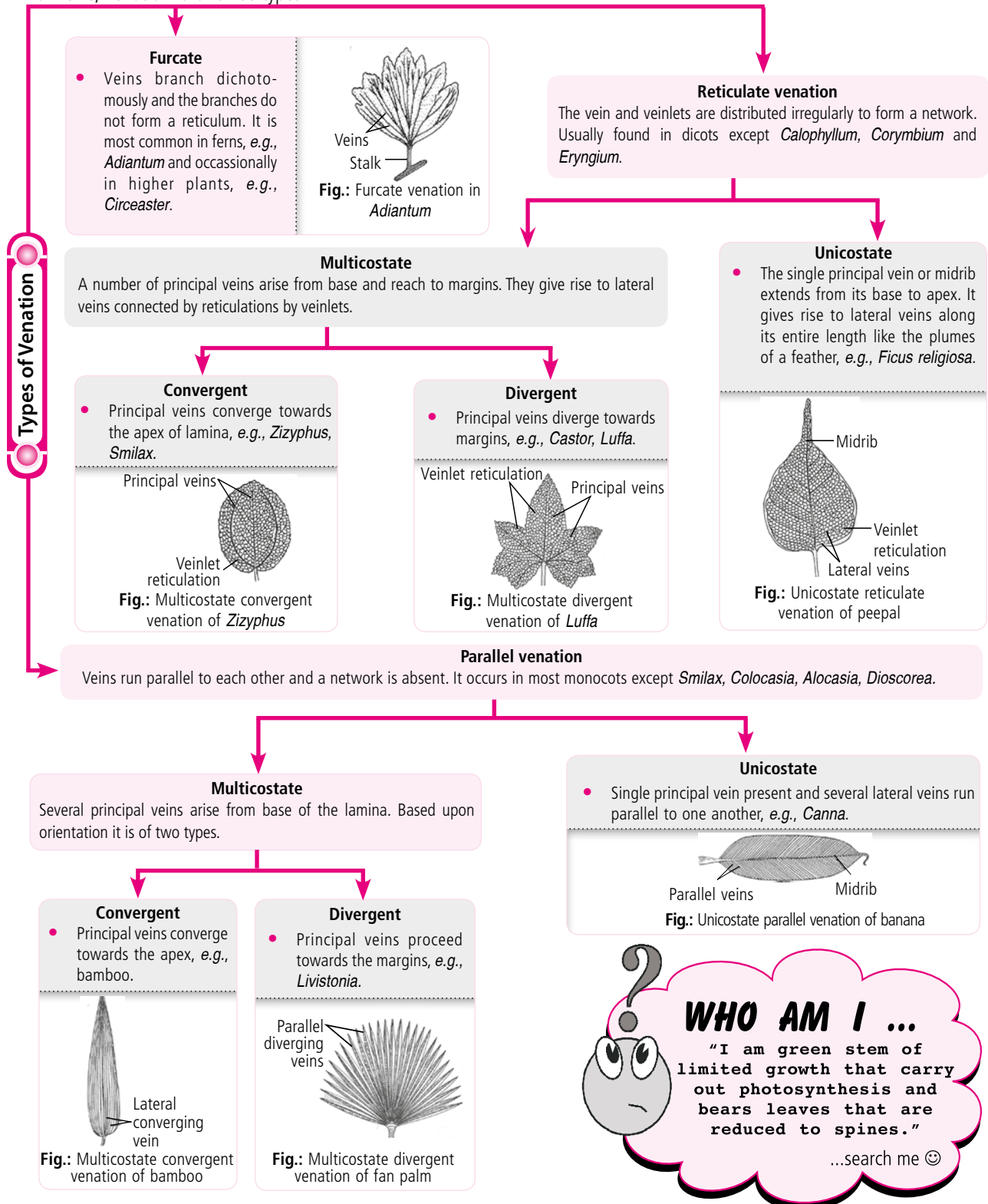
Phyllotaxy (Phyllotaxis)

- Phyllotaxy refers to the arrangement of leaves on the stem or its branches. The aim of phyllotaxy is to orient the leaves in such a manner that all of them get maximum exposure to sunlight to perform their main function of photosynthesis.



Venation

- The arrangement of veins and veinlets in the lamina of a leaf is called venation. Depending upon the distribution pattern of veins, venation is of three types:



Types of Leaf

Types of Leaf

(Depending upon the incision of lamina)

Simple leaf

Possess a single or undivided lamina with smooth or incised margins but the marginal incisions are not deep up to midrib or petiole.

Compound leaf

Possesses lamina divided into a number of leaflets with incisions deep upto midrib or petiole.

Pinnate simple leaf

- The incisions point towards the midrib, e.g., *Raphanus*.



Fig.: Pinnate simple leaf of *Raphanus sativus*

Palmate simple leaf

- The incisions are pointed towards the petiole, e.g., *Ricinus*.



Fig.: Palmate simple leaf of *Ricinus*

Pinnate compound leaf

- The incisions are pointed towards rachis (midrib) and leaflets are present laterally in opposite manner. Pinnate compound leaves are of various kinds:
 - Unipinnate - Leaf divided only once in a pinnate fashion. It can be:
 - Paripinnate *Cassia*, *Cicer*, etc.
 - Imparipinnate e.g., rose, *Azadirachta*, etc.
 - Bipinnate - Pinnate leaf is divided twice pinnately, e.g., *Mimosa*, *Acacia*, etc.
 - Tripinnate - Leaf is thrice pinnate, e.g., *Moringa*, *Melia* etc.
 - Decompound - Leaf is more than thrice pinnate, e.g., *Coriandrum*, *Daucus*, etc.

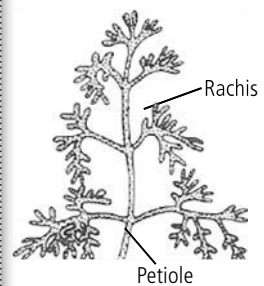


Fig.: Decompound leaf of *Daucus*

Palmate compound leaf

- The incisions are pointed towards the base and are connected to the petiole tip. Depending upon the number of leaflets present, it can be
 - Unifoliolate - Single leaflet separated from petiole e.g., *Citrus*, etc.
 - Bifoliolate - Two leaflets attached side by side at the tip of petiole, e.g., *Bignonia*, etc.
 - Trifoliolate - Three leaflets e.g., *Aegle*, *Butea*, etc.
 - Quadrifoliolate - Four leaflets attached to tip of petiole, e.g., *Marsilea*, etc.
 - Multifoliolate - Five or more leaflets present at the tip of petiole, e.g., *Gynandropsis*, *Bombax*, etc.



Fig.: Unifoliolate compound leaf of *Citrus*

Modifications of Leaf

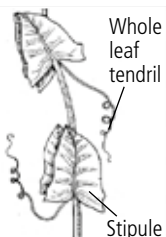


Fig.: Whole leaf tendril of *Lathyrus aphaca*

Leaf tendrils

Tendrils are wire-like sensitive structures that help the plants in climbing by coiling around a support. These can be **whole leaf tendrils**, e.g., *Lathyrus aphaca* (wild pea); **leaflet tendrils**, e.g., *Lathyrus odoratus* (sweet pea); **petiolar tendrils**, e.g., *Tropaeolum majus* (garden nasturtium); **rachis** and **petiolute tendrils**, e.g., *Clematis*; **rachis tip tendrils**, e.g., *Lens culinaris* (lentil); **leaf tip tendrils**, e.g., *Gloriosa superba* (Glory lily) and **stipular tendrils**, e.g., *Smilax*.

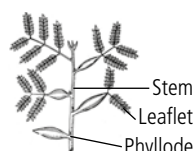


Fig.: Phyllode of *Acacia*

Phyllodes

Phyllodes are flat, green coloured, photosynthetic leaf-like modifications of petiole and rachis, e.g., Australian *Acacia* (*Acacia auriculiformis*), *Parkinsonia*, etc.

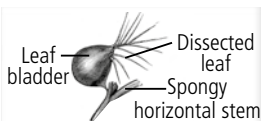


Fig.: Leaf bladder of *Utricularia*

Leaf bladder

In insectivorous hydrophytes like *Utricularia*, leaf is profusely dissected and some parts of it are modified into bladder-like structures which help in catching water insects.

Leaf spines

Leaf gets modified into **spine** in order to protect the plant from grazing animals as well as reduce the rate of transpiration, e.g., *Berberis*, *Acacia*.

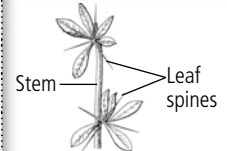


Fig.: Leaf spines of barberry

Leaflet hooks

The terminal leaflets of the compound leaves become transformed into three stiff claw-like and curved hooks. **Leaflet hooks** help the plant in climbing, e.g., *Doxantha unguis-cati*.

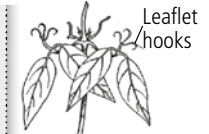


Fig.: Leaflet hooks of *Doxantha unguis-cati*

Leaf pitcher

In some insectivorous plants, the leaves or their parts are modified to form a large pitcher that is a special **insect catching organ**. They catch and digest insects to fulfill their nitrogen requirements, e.g., *Nepenthes*, *Dischidia*, etc.

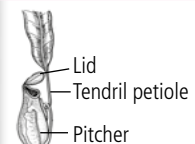


Fig.: Leaf pitcher of *Nepenthes*

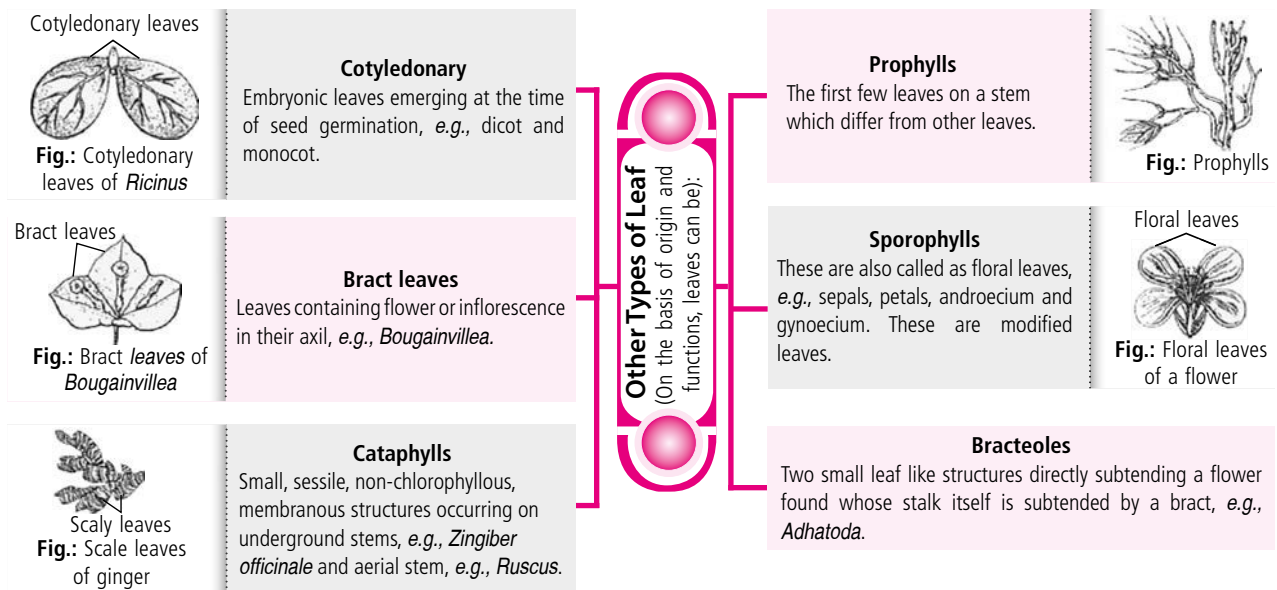
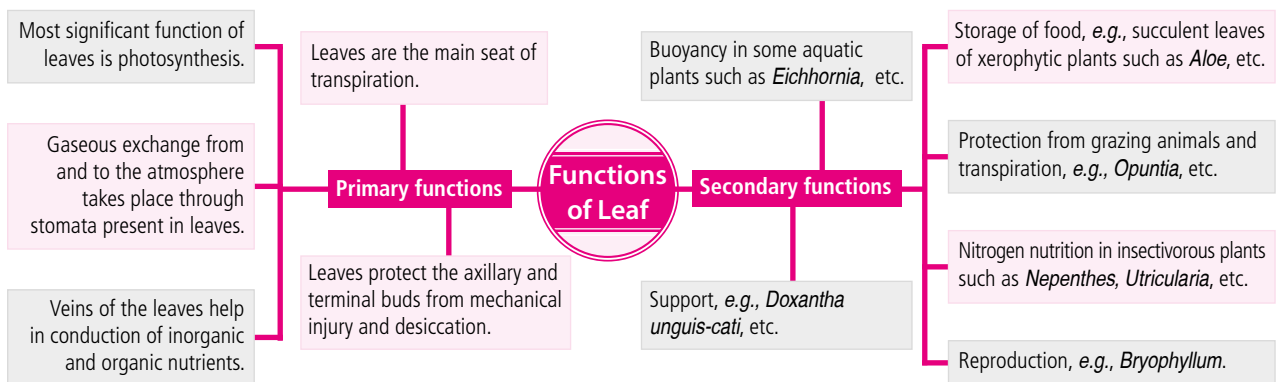
Succulent leaves

Succulent leaves occur in plants of saline and xerophytic habitats, e.g., *Aloe*, *Agave*, *Bryophyllum*.



Fig.: Succulent leaves of *Aloe*

Modifications of Leaf

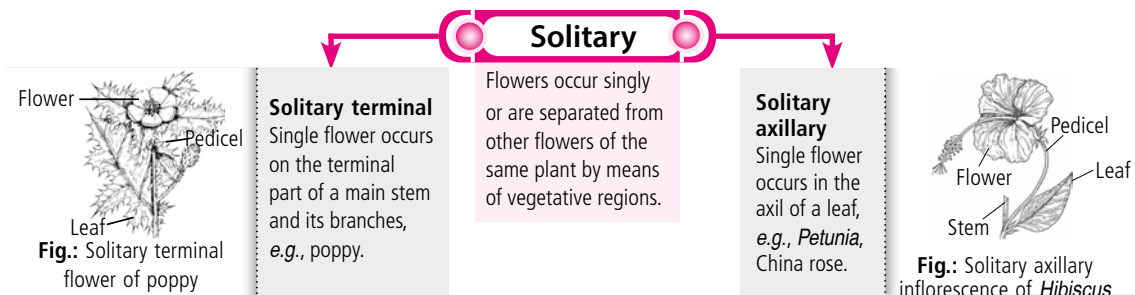


Thorns, Spines, Prickles and Bristles

Thorns are sharp, pointed, straight or curved hard structures that prevent excessive transpiration and protect plant from grazing animals.
Spines are modified leaves or parts of leaf (a vascular strand without well developed bark).
Prickles refers to superficial outgrowths of stem or leaves that do not possess a vascular cylinder and hence can easily be separated.
Bristles are stiff hair like structures that become thickened due to deposition of silica or calcium carbonate.

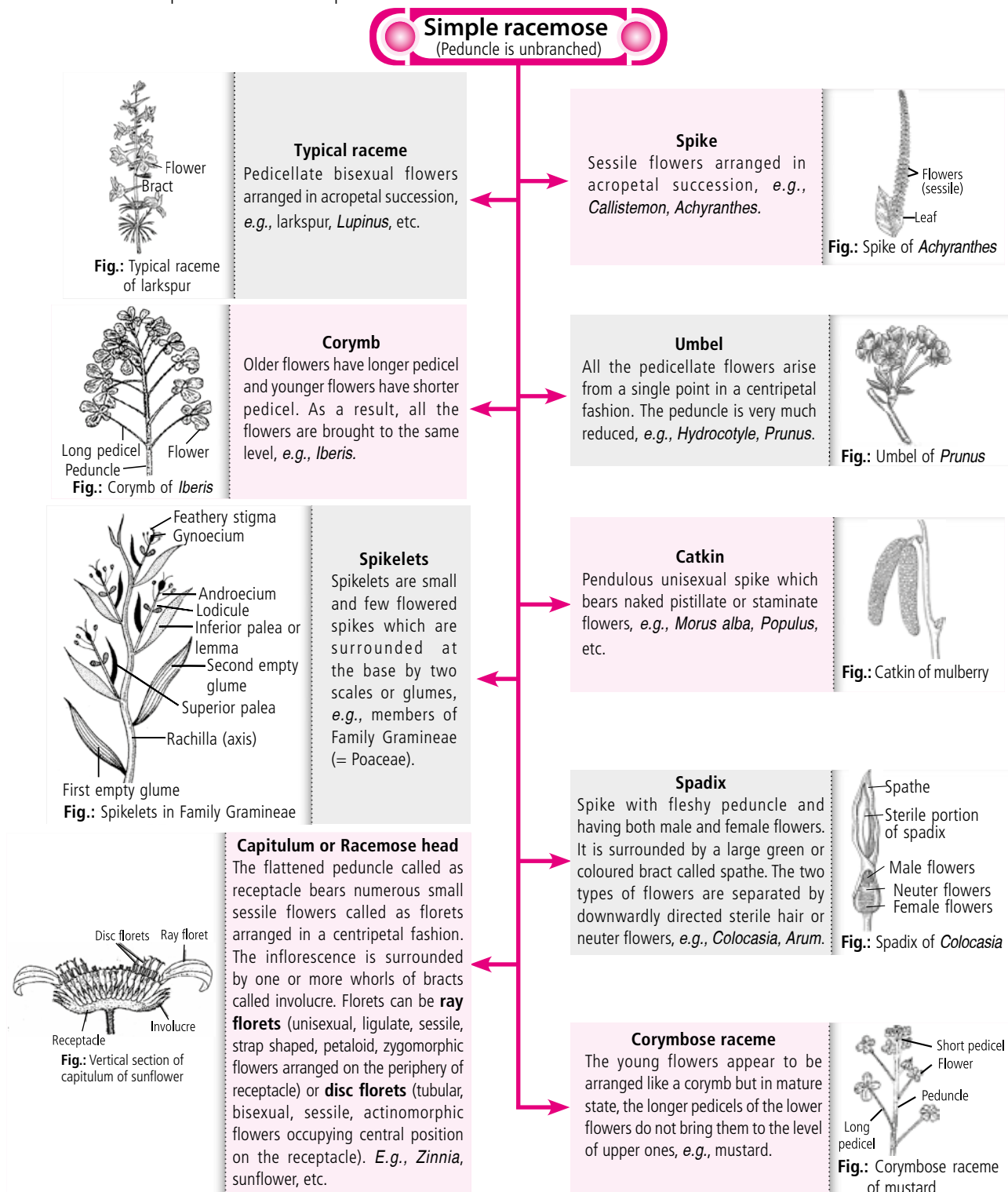
INFLORESCENCE

- The arrangement and distribution of flowers on the shoot system of a plant is called **inflorescence**.
- It refers to the modified shoot specialised to form flowers.
- The axis of the inflorescence is called peduncle. The stalk of the individual flower is called pedicel.
- Five main types of inflorescence are recognised. These are solitary, racemose, cymose, mixed and specialised.



Racemose

- An indeterminate type of inflorescence which shows indefinite growth and bears a number of flowers due to the presence of active growing point. The arrangement of flowers on peduncle is either **acropetal** (i.e., younger towards the apex and older towards the base) or **centripetal** (i.e., younger towards the centre and older towards the periphery).
- There can be simple racemose or compound racemose.



- Capitulum is of two types viz., homogamous and heterogamous.
 - **Homogamous head** – In homogamous heads, all florets are alike in structure and function. They are bisexual and either tubular as in *Vernonia* and *Ageratum* or ligulate as in *Cichorium* and *Taraxacum*.
 - **Heterogamous head** – The head/capitulum consists of different types of florets, e.g., *Helianthus*. In heterogamous heads, ray florets are towards the periphery and disc florets are at the centre of the inflorescence. The disc florets are actinomorphic and bisexual while the ray florets are ligulate and generally pistillate or neutral. The inflorescence becomes conspicuous and attractive due to the brightly coloured ray florets.
- Head inflorescence (or capitulum) is considered to be the highly evolved type of inflorescence because of following reasons:
 - There is economy of biological materials.
 - There is enhancement of attraction due to aggregation of florets.
 - Maximum protection of flowers is ensured.
 - A single visit of the insect can pollinate many flowers.

Compound racemose

- An indefinite or indeterminate inflorescence in which the peduncle is branched repeatedly once or twice in a **racemose** fashion.
- It can be **panicle**, (e.g., *Delonix*, *Cassia fistula*), **compound corymb**, (e.g., *Brassica oleracea* var. *botrytis* (cauliflower), **compound umbel**, (e.g., *Foeniculum vulgare*, *Coriandrum sativum* etc.), **compound spike**, (e.g., *Amaranthus*, wheat), **compound spadix**, (e.g., *Cocos*, date palm) or **compound capitulum**, (e.g., *Echinops*).



Fig.: Compound spadix of coconut



Fig.: Compound umbel of *Chaerophyllum*

Uniparous or monochasial cyme

The terminal bud of main axis ends in flower. A single lateral branch pushes it to one side but also itself ends in a flower. It is of two types:

Scorpioid cyme

Flowers are alternately borne on both the sides, e.g., *Tecoma*, *Ranunculus*, *Heliotropium*.



Fig.: Scorpioid cyme of *Freesia*

Helicoid cyme

All the flowers are borne on the same side forming a sort of helix, e.g., *Drosera*, *Begonia*, *Myosotis*.



Fig.: Helicoid cyme of *Myosotis*

Cymose

It is a determinate inflorescence where main axis (peduncle) terminates into a flower and further growth takes place by lateral branches. The arrangement of flowers is **basipetal** (i.e., younger towards the base and older towards the apex) or **centrifugal**, (i.e., younger towards the periphery and older towards the centre). It is of following types:

Multiparous or Polychasial cyme

More than two lateral branches continue the growth of inflorescence when the parent axis ends in a flower, e.g., *Hamelia*, *Calotropis*.



Fig.: Polychasial cyme of *Hamelia*

Cymose head

Sessile or subsessile flowers are borne centrifugally around a receptacle, e.g., *Albizia*, *Anthocephalus cadamba*, *Acacia*.

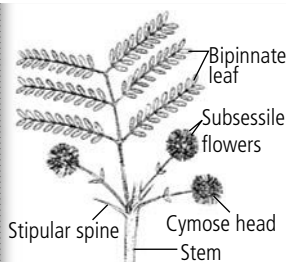


Fig.: Cymose head of *Acacia*

Biparous or Dichasial cyme

The main axis terminates in a flower. A pair of lateral branches arise below the terminal flower which too, terminate into a flower. The process is repeated several times, e.g., *Spergula*, *Stellaria*, *Dianthus*, jasmine, etc.

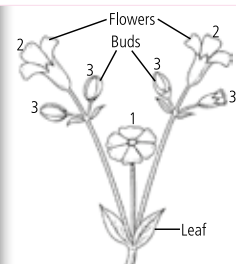


Fig.: Dichasial cyme of *Dianthus*



Fig.: Scapigerous

Scapigerous head

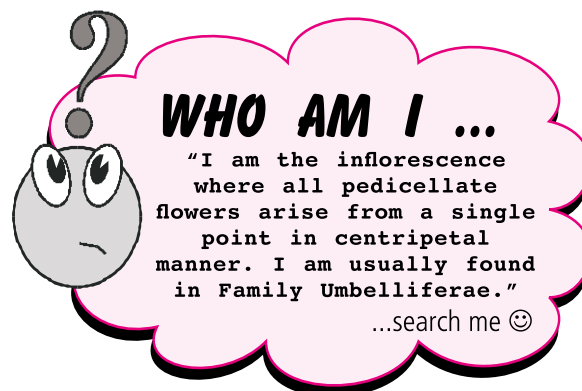
The leafless flowering axis known as **scape** bears clusters of flowers that form a head which is covered by **spaths**, e.g., *Allium cepa*.

Mixed Inflorescence

- Here, two or more types of inflorescence get mixed up to form a mixed inflorescence. It may be: **panicle of spikelets**, (e.g., *Oryza sativa*), **corymb of capitula**, (e.g., *Ageratum conyzoides*), **mixed spadix**, (e.g., banana), **thyrsus** (e.g., grapevine), etc.

Intercalary inflorescence - *Callistemon* (Bottle brush)

Longest inflorescence - *Amorphophalus*



Hypanthodium

The receptacle (peduncle) is fleshy and forms hollow structure with an apical opening (orifice) guarded by hairy structures. Three types of flower develop on the inner surface of the receptacle.

The female flowers are towards the base, male flowers are towards the orifice and the short styled sterile female flowers (gall flowers) are present in between, e.g., *Ficus religiosa* (peepal), *Ficus benghalensis* (banyan), *Ficus carica* (fig).

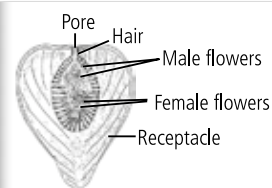


Fig.: Hypanthodium of fig

Special Inflorescence

Verticillaster

A modified condensed dichasial cyme like inflorescence in which two whorls of 3 to 9 flowers are borne in dichasial cyme like manner on either side of a node, e.g., *Ocimum sanctum*.

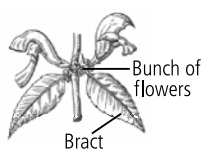


Fig.: Verticillaster inflorescence of *Ocimum sanctum*

Cyathium

The inflorescence looks like a flower. The bracts or the involucre become fused to form a cup shaped structure. The inflorescence contains pedicellate, achlamydeous, unisexual flowers of both the types, male and female. The cup encloses a single female flower surrounded by a large number of male flowers. E.g., *Euphorbia pulcherrima*.

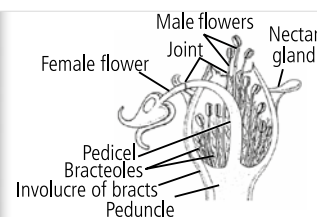


Fig.: Cyathium inflorescence of *Euphorbia*

SPEED PRACTICE

- Hygroscopic aerial roots are able to absorb water from atmosphere due to the presence of
 - root hair
 - haustoria
 - velamen
 - lenticels.
- In which of the following plants, buds are modified into tendrils?
 - Passiflora*, *Agave*
 - Cucurbita*, *Potamogeton*
 - Antigonon*, *Passiflora*
 - Vitis*, *Utricularia*
- Fleshy buds that participate in perennation of aquatic plants are found in
 - Potamogeton*
 - Oxalis*
 - Dioscorea*
 - Cardamine*.
- Read the given statements and select the incorrect one.
 - Phylloclades are flattened green stems of unlimited growth.
 - Climbers are weak aerial stems that are unable to coil around an upright support by itself.
 - Bulbils are swollen due to storage of food and function as an organ of vegetative propagation.
 - Thalamus is a highly condensed shoot with distinct nodes and internodes.

5. Consider the following statements and select the incorrect ones regarding the modifications of stem.
- Twiners are flexible and insensitive stems that are unable to coil around an upright support by itself.
 - Procumbent trailers are shoots that spread horizontally along the ground with branches spreading in all directions.
 - Offsets are one internode long small runners found in rosette plants at the surface of ground or water.
 - Scramblers are stem having sensitive structures that rise up a support by itself.
- (a) I, III and IV (b) II and III
(c) I, II and IV (d) I, II, III and IV
6. A bulb in which fleshy scales represent buds that occur in irregular concentric rings around the central floral axis is found in
- (a) onion (b) garlic
(c) tulip (d) lily.
7. A compound corymb showing indeterminate inflorescence in which flowers remain undeveloped is found in
- (a) *Brassica oleraceae* (b) *Cassia fistula*
(c) *Azadirachta indica* (d) *Foeniculum vulgare*.
8. Spines present on the areoles of *Opuntia* represent
- (a) stems (b) leaves
(c) buds (d) scales.
9. Identify the incorrect pair.
- (a) Tap root system – *Asparagus*
(b) Fibrous root system – Wheat
(c) Fasciculated roots – *Dahlia*
(d) Stilt roots – *Sorghum*
10. An inflorescence has a small conical receptacle surrounded by involucre of coloured bracts, giving the appearance of a flower. It comprises of pedicellate achlamydeous unisexual flowers with single female flower centrally placed surrounded by numerous centrifugally arranged male flowers. This type of inflorescence is identified as
- (a) verticillaster (b) hypanthodium
(c) cyathium (d) capitulum.

11. Select the correctly matched pair.
- (a) Unbranched stem – *Marchantia*
(b) Dichotomous branching – *Saraca*
(c) Monopodial branching – *Eucalyptus*
(d) Dichasial branching – Sugarcane
12. Match the columns and select the correct option.
- | Column I | Column II |
|--------------------------|-------------------------|
| A. Uniparous helicoid | (i) <i>Heliotropium</i> |
| B. Biparous cyme | (ii) <i>Drosera</i> |
| C. Monochasial scorpioid | (iii) <i>Asclepias</i> |
| D. Polychasial cyme | (iv) <i>Spergula</i> |
- (a) A-(ii), B-(iv), C-(i), D-(iii)
(b) A-(iii), B-(ii), C-(i), D-(iv)
(c) A-(iii), B-(iv), C-(i), D-(ii)
(d) A-(iii), B-(ii), C-(iv), D-(i)
13. Roots carry out the function of balancing in
- (a) *Cuscuta* (b) *Lemna*
(c) *Utricularia* (d) *Tinospora*.
14. Identify the correct set of statements.
- In leguminous plants, the swollen leaf base is called pulvinus.
 - In Australian *acacia*, the buds become fleshy and store mucilage.
 - Curcuma* is a straggling rhizome with sympodial axis.
 - The leaves in *Alstonia* show alternate phyllotaxy.
- (a) I and IV (b) II and III
(c) I and III (d) II, III and IV
15. Read the given statements and select the correct option.
- Statement 1 :** Mangrove plants possess pneumatophores.

Contributed by : Kunal Sharma (Delhi), Ajay Tyagi (U.P.)

SOLUTIONS TO NOVEMBER 2017 CROSSWORD

1 T	2 I	N	T	3 E	G	R	A	4 S	5 E		6 T	7 S		8 E
A		9 B	E	N	I	G	N	P	C		U	T		P
X				S			10 D	O	H		B	E		I
O	11 A	M	N	I	O	N	I	R	I		E	L		S
N				L				A	O	U	12 U	R	E	A
O	13 U	L	N	A				G	G	R	14 H			15 K
M				G				Y	O	I	U		E	S
Y	16 A	R	B	E	R			N	N	D	M		L	I
17 S		U	L	P	H	U	R	I	Y	A	U		P	S
	18 H	E	M	E			C				S	19 S	U	F
20 S		U	B	E	R	I	N		21 I	N	22 U	L	I	23 T
24 D	25 A	P	O	P	L	A	S	T	26 P	V				27 I
Y	28 M	E	N	I	N	G	E	S	I	U			R	S
A		29 R	E	L	A	X	I	N	L	L			I	T
D			30 B	I	O	M	E		I	A			S	A

MPP-9 CLASS XII			ANSWER		KEY
1. (c)	2. (b)	3. (d)	4. (b)	5. (c)	
6. (c)	7. (d)	8. (b)	9. (b)	10. (d)	
11. (d)	12. (d)	13. (b)	14. (b)	15. (c)	
16. (d)	17. (b)	18. (d)	19. (a)	20. (a)	
21. (d)	22. (a)	23. (d)	24. (b)	25. (c)	
26. (a)	27. (d)	28. (c)	29. (b)	30. (c)	
31. (b)	32. (b)	33. (c)	34. (d)	35. (b)	
36. (a)	37. (a)	38. (a)	39. (a)	40. (c)	

Statement 2 : Pneumatophores help the plant to get oxygen for respiration.

- (a) Both statements 1 and 2 are true and 2 is the correct explanation of 1.
 (b) Both statements 1 and 2 are true but 2 is not the correct explanation of 1.
 (c) Statement 1 is true but statement 2 is false.
 (d) Both statements 1 and 2 are false.

16. The modified structure of stem that possesses vascular cylinder surrounded by a bark of thick walled cells is

- (a) thorn (b) prickle
 (c) bristle (d) spine.

17. Refer to the given figures X, Y and Z and select the correct option regarding them.



- (a) X shows an inflorescence in which sessile flowers are borne on elongated peduncle in centripetal fashion.
 (b) Y type of inflorescence is found in Family Gramineae.
 (c) 'Z' is a modified spike with fleshy peduncle and a large coloured bract called spathe.
 (d) X is commonly found in *Betula* and *Quercus*.

18. Scape is found in which of the given plants?

- (a) Banana (b) Bamboo
 (c) Sugarcane (d) Palm

19. The leaf lamina is modified into a pitcher to store rainwater in

- (a) *Nepenthes* (b) *Sarracenia*
 (c) *Utricularia* (d) *Dischidia*.

20. Which of the following does not show reticulate venation?

- (a) *Zizyphus* (b) *Livistonia*
 (c) *Ricinus* (d) *Dioscorea*

21. Consider the given figure and select the correct statements related to it.



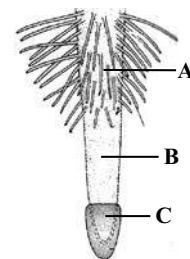
- I. These are arched runners which can cross over small obstacles.
 II. It has one or more nodes possessing scale leaves and axillary buds.

III. The tip of the stem grows below the level of ground.

IV. It is found in *Colocasia*.

- (a) I and IV (b) II and IV
 (c) I, II and III (d) I, II, III and IV

22. Which of the following statements is correct with respect to the given figure showing different zones of a typical root?



- (a) Zone B mainly helps in absorption of water.
 (b) Quiescent centre is present in zone B.
 (c) Zone A is most suitable for anatomical studies of root.
 (d) Differentiation of cells can be observed in zone C.

23. When the leaflets are arranged laterally all along the length of rachis like the plumes of a feather, such a leaf is called

- (a) multifoliate palmately compound leaf
 (b) pinnately compound leaf
 (c) bifoliate palmately compound leaf
 (d) unifoliate palmately compound leaf.

24. Match the columns and select the correct option from the given codes.

Column I

- A. Leaflet tendrils
 B. Rachis tip tendrils
 C. Stipular tendrils
 D. Petiolar tendrils
 E. Leaf tip tendrils

Column II

- (i) *Tropaeolum majus*
 (ii) *Gloriosa superba*
 (iii) *Lens culinaris*
 (iv) *Lathyrus odoratus*
 (v) *Smilax*

- (a) A-(iv), B-(v), C-(ii), D-(iii), E-(i)
 (b) A-(v), B-(iii), C-(ii), D-(iv), E-(i)
 (c) A-(iv), B-(iii), C-(v), D-(i), E-(ii)
 (d) A-(i), B-(iv), C-(v), D-(iii), E-(ii)

25. Select the incorrect statement regarding racemose type of inflorescence.

- (a) The growing point seldom ends in a flower.
 (b) Flowers arise laterally and are acropetally or centripetally arranged.
 (c) The floral axis is either sympodial or multipodial.
 (d) Newly formed fruits are not protected by flowers.

ANSWER KEY

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (c) | 2. (c) | 3. (a) | 4. (d) | 5. (c) |
| 6. (b) | 7. (a) | 8. (b) | 9. (a) | 10. (c) |
| 11. (c) | 12. (a) | 13. (b) | 14. (c) | 15. (a) |
| 16. (a) | 17. (c) | 18. (a) | 19. (d) | 20. (b) |
| 21. (d) | 22. (c) | 23. (b) | 24. (c) | 25. (c) |



MPP-9 MONTHLY Practice Problems

Class XI

This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

- **Body Fluids and Circulation**
- **Excretory Products and Their Elimination**

Total Marks : 160

Time Taken : 40 Min.

- Which of the following is responsible for initiating the rhythmic activity of heart?
(a) Atrio-ventricular node (b) Sinoatrial node
(c) Bundle of His
(d) Pulmonary semilunar valves
- Select the correct statements for atherosclerosis.
I. High blood plasma concentration of cholesterol in the form of low density lipoprotein (LDL) is responsible for atherosclerosis.
II. Calcification of the plaques makes the walls of the arteries stiff and rigid.
III. Blood leaks from the ruptured wall of arteries may clot and block the pathway of blood flow.
IV. Lumen of the artery decreases and the flow of blood is reduced.
(a) I only (b) II and III
(c) III and IV (d) I and IV
- Pick the odd ones in each of the following groups and select the correct option.
(i) Renal pelvis, Medullary pyramid, Renal cortex, Renal papilla
(ii) Afferent arteriole, Glomerulus, Vasa recta, Efferent arteriole
(iii) Glomerular filtration, Antidiuretic hormone, Hypertonic urine, Collecting duct
(iv) Trigone, Urinary bladder, Detrusor muscle, Urethral orifice
(i) (ii) (iii) (iv)
(a) Renal pelvis Henle's loop Collecting duct tubule Urinary bladder
(b) Renal papilla Afferent arteriole Antidiuretic hormone Urinary bladder
(c) Medullary pyramid Efferent arteriole Hypertonic urine Detrusor muscle
(d) Renal cortex Vasa recta Glomerular filtration Urethral orifice
- Select the incorrect statement.
(a) Tubular reabsorption takes place by passive and active transport.
(b) ADH decreases the reabsorption of water in the DCT and collecting duct.
(c) Cortical nephrons control plasma volume under normal water supply.
(d) A normal adult person secretes about 1.5 litres of urine in 24 hours.
- Clotting factors III, VIII, IX and XII respectively are
(a) Thromboplastin, antihemophilic factor A, Stuart Prower factor and antihemophilic factor C
(b) Prothrombin, Calcium, Christmas factor, Glass factor
(c) Fibrinogen, antihemophilic factor B, Hageman factor, Fibrin-stabilising factor
(d) Thromboplastin, Antihemophilic factor A, Christmas factor, Glass factor.
- Atrial Natriuretic Factor hinders the regulation of kidney by
(a) renin-angiotensin aldosterone system
(b) stimulating release of antidiuretic hormone
(c) inhibiting aldosterone synthesis
(d) increasing H^+ reabsorption in PCT.
- Identify A, B, C and D in the given table.

Leucocytes	Percentage of leucocyte	Shape of nucleus
Monocytes	2-10	A
B	0-1	3 lobed
Neutrophils	C	Many lobed
D	1-6	Bilobed

A B C D

(a) Large rounded Eosinophils 20-45 Lymphocytes
(b) Bean shaped Basophils 40-70 Eosinophils
(c) 5-7 lobed Basophils 40-70 Lymphocytes
(d) S-shaped Lymphocytes 20-45 Basophils

8. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
A. Heart failure	(i) Heart muscle is suddenly damaged by an inadequate blood supply
B. Cardiac arrest	(ii) Chest pain due to inadequate O ₂ reaching the heart muscles
C. Heart attack	(iii) Atherosclerosis
D. Coronary artery disease (CAD)	(iv) Heart does not pump blood effectively enough to meet the needs of the body
E. Angina pectoris	(v) Heart stops beating
(a) A-(iv), B-(v), C-(i), D-(iii), E-(ii)	
(b) A-(v), B-(iv), C-(i), D-(iii), E-(ii)	
(c) A-(iv), B-(v), C-(i), D-(ii), E-(iii)	
(d) A-(v), B-(iv), C-(ii), D-(iii), E-(i)	

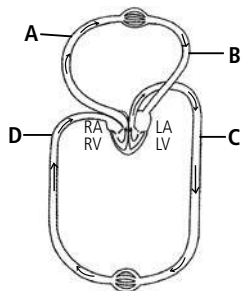
9. Which of the following statements is/are true for Bowman's capsule?

- It is a single layered cup-shaped structure.
 - Its lumen is continuous with broad lumen of the renal tubule.
 - Its layer consists of a special type of cells called podocytes.
- (a) I and II only (b) II only
(c) III only (d) All of these

10. During ventricular systole,
- oxygenated blood is pumped into the pulmonary artery and deoxygenated blood is pumped into the artery
 - oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary vein
 - oxygenated blood is pumped into the pulmonary vein and deoxygenated blood is pumped into the pulmonary artery
 - oxygenated blood is pumped into the aorta and deoxygenated blood is pumped into the pulmonary artery.

11. Which of the following causes an increase in sodium reabsorption in the distal convoluted tubule?
- Increase in aldosterone level
 - Increase in antidiuretic hormone level
 - Decrease in aldosterone level
 - Decrease in antidiuretic hormone level

12. In the figure given below, which blood vessel represents vena cava?



- (a) C (b) D (c) A (d) B

13. Read the given statements and select the correct option.

Statement A : Glomerular filtration does not require the expenditure of energy by kidney cell.

Statement B : Afferent arterioles are narrower than the glomerular capillaries so, there is continuous process of glomerular filtration.

- Both statements A and B are correct and B is the correct explanation of A.
- Both statements A and B are correct but B is not the correct explanation of A.
- Statement A is correct but statement B is incorrect.
- Both statements A and B are incorrect.

14. Read the following statements and select the incorrect ones.

- The glomerular filtration rate is the amount of filtrate formed by each kidney per day.
 - The amount of blood pumped by heart per minute is called cardiac output.
 - During joint diastole, the blood flows from ventricles into the aorta and pulmonary artery as semilunar valves open due to fall in pressure within the ventricles.
 - Capsular hydrostatic pressure is the pressure exerted against the filtration membrane by the filtrate in Bowman's capsule during filtration.
- (a) I and III (b) II and IV
(c) II, III and IV (d) All of these.

15. Globulins contained in human blood plasma are primarily involved in

- osmotic balance of body fluids
- oxygen transport in the blood
- clotting of blood
- defence mechanisms of body.

16. Select the group containing ammonotelic animals only.

- Earthworm, frog, turtle, pigeon
- Crocodile, earthworm, leech, bony fish
- Cockroach, land snail, prawn, toad
- Tapeworm, lizard, shark, leech

17. Read the following statements.

- First heart sound is caused by closure of semilunar valves.
- Heart sound 'dup' marks the end of ventricular systole.
- Heart beat is rhythmic contraction and relaxation in aorta and its main arteries.
- Vagus cranial nerve decreases the heart beat.

Select the correct statements.

- (i) and (iv) (b) (ii) and (iv)
- (i), (ii) and (iii) (d) (iii) and (iv)

18. During blood coagulation, X is released at the site of an injury. Identify X.

- Prothrombinase (b) Prothrombin
- Thromboplastin (d) Fibrinogen

19. Read the following statements and choose the correct ones.

- Atrial Natriuretic Factor stimulates the release of renin from JGA.

- (ii) Systemic circulation is the flow of oxygenated blood from heart to body and deoxygenated blood from body to heart.
- (iii) Adrenaline secreted by the medulla of adrenal glands accelerates the heart beat by influencing the SA node, only during emergency.
- (iv) Aldosterone decreases the rate of reabsorption of Na^+ in the nephrons.
- (a) (i) and (iv) only (b) (i), (ii) and (iv) only
(c) (ii) and (iii) only (d) (iv) only

20. Match Column I with Column II.

Column I	Column II
A. PCT	(i) Transitional epithelium
B. Urinary bladder	(ii) Cuboidal epithelial cells
C. JGA	(iii) Counter current mechanism
D. Glomerulus	(iv) Filtration
E. Loop of Henle	(v) Renin
(a) A-(ii), B-(i), C-(v), D-(iv), E-(iii)	
(b) A-(i), B-(iii), C-(iv), D-(v), E-(ii)	
(c) A-(ii), B-(v), C-(iv), D-(i), E-(iii)	
(d) A-(i), B-(ii), C-(v), D-(iii), E-(iv)	

21. What changes can one observe in ECG from the normal, when insufficient oxygen is received by heart muscle?
- (a) S-T segment is elevated
(b) T wave is flat
(c) P-R interval is short
(d) Enlarged QR waves

22. Read the following statements and select the correct option.

Statement A : In arteriosclerosis, clot formation in coronary artery may lead to heart attack.

Statement B : Cholesterol deposition and calcification cause hardening of arteries.

- (a) Both statements A and B are correct and B is the correct explanation of A.
(b) Both statements A and B are correct but B is not the correct explanation of A.
(c) Statement A is correct but statement B is incorrect.
(d) Both statements A and B are incorrect.

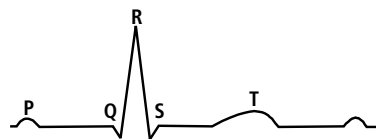
23. Collecting ducts unite to form

- (a) ducts of Bellini (b) columns of Bertin
(c) macula densa (d) trigone.

24. The urine of normal person does not show presence of compounds like

- (a) creatinine, ammonia
(b) ammonia, allantoin
(c) albumin, glucose
(d) oxalic acid, hippuric acid.

25. The given figure is the ECG of a normal human. Which one of its components is correctly interpreted below?



- (a) Complex QRS - can help in determining heart rate
(b) Peak T - initiation of total cardiac contraction
(c) Peak P and peak R together - systolic and diastolic blood pressures
(d) Peak P - initiation of left atrial contraction only

26. Thrombosis occurs most frequently in which coronary artery?

- (a) Right coronary artery
(b) Right circumflex coronary artery
(c) Left anterior descending coronary artery
(d) Left circumflex coronary artery

27. If Henle's loop were absent from mammalian nephron, which one of the following is to be expected?

- (a) There will be no urine formation.
(b) There will be hardly any change in the quality and quantity of urine formed.
(c) The urine will be more concentrated.
(d) The urine will be more dilute.

28. Which among the following statements is correct?

- (a) Iron present in heme exist in Fe^{3+} state.
(b) During early embryonic life, RBCs are mainly produced in liver and spleen.
(c) Erythrocyte sedimentation rate in women is 0-5 mm and in men is 0-7 mm, in first hour.
(d) Rouleaux formation is favoured by fibrinogen.

29. In micturition,

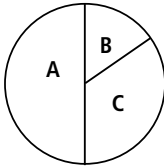
- (a) urethra relaxes (b) ureter relaxes
(c) ureter contracts (d) urethra contracts.

30. Consider the following statements and select the correct option.

- I. Lymph is the colourless part of tissue fluid comprising of blood plasma but devoid of blood corpuscles.
II. Macula densa are the epithelial cells of distal convoluted tubule that come in contact with afferent and efferent arterioles.
III. Lymphatic capillaries unite to form lymphatic vessels with numerous valves.
IV. The proximal convoluted tubule lined by epithelial cells having few microvilli join to form large ducts of Bellini.

The correct statements are

- (a) I and II (b) III and IV
(c) II and III (d) I and IV.

31. A person who is on a long hunger strike and is surviving only on water, will have
 (a) less amino acids in his urine
 (b) more glucose in his blood
 (c) less urea in his urine
 (d) more sodium in his urine.
32. If the systolic pressure is 120mm Hg and diastolic pressure is 80mm Hg, the pulse pressure is _____.
 (a) $120 \times 80 = 9600$ mm Hg
 (b) $120 + 80 = 200$ mm Hg
 (c) $120 - 80 = 40$ mm Hg
 (d) $\frac{120}{80} = 1.5$ mm Hg
33. Read the following statements and select the correct option.
Statement A : Deficiency of vitamin K causes blood loss during an injury.
Statement B : Vitamin K is essential for synthesis of thromboplastin in liver.
 (a) Both statements A and B are correct and B is the correct explanation of A.
 (b) Both statements A and B are correct but B is not the correct explanation of A.
 (c) Statement A is correct but statement B is incorrect.
 (d) Both statements A and B are incorrect.
34. Which of the following excretory organ is correctly matched with the organism in which it is found?
 (a) Nephridia – Crustaceans
 (b) Malpighian tubules – Annelids
 (c) Antennal gland or green glands – Insects
 (d) Flame cells – Platyhelminthes
35. If due to some injury the chordae tendinae of the tricuspid valve of the human heart is partially non-functional, what will be the immediate effect?
 (a) The flow of blood into the aorta will be slowed down.
 (b) The pacemaker will stop working.
 (c) The blood will tend to flow back into the left atrium.
 (d) The flow of blood into the pulmonary artery will be reduced.
36. Which one of the following statements is correct with respect to kidney function regulation?
 (a) When someone drinks lot of water, ADH release is suppressed.
 (b) Exposure to cold temperature stimulates ADH release.
 (c) An increase in glomerular blood flow stimulates formation of angiotensin II.
 (d) During summer when body loses lot of water by evaporation, the release of ADH is suppressed.
37. An X-ray of the lower abdomen shows a shadow in the region of the ureter suspected to be an ureteric calculus. A possible clinical symptom would be
 (a) acute renal failure (ARF)
 (b) dysuria and haematuria
 (c) motor aphasia
 (d) chronic renal failure (CRF).
38. If an abnormally increased amount of connective tissue were to connect together the serous visceral and parietal pericardium, which of the following events would most likely result?
 (a) Strengthening of the pericardial layers with an improvement of cardiac function.
 (b) Decreased fluid production in the pericardial cavity since it is no longer necessary.
 (c) Interference with the heart's normal mechanical activity.
 (d) Decreased friction between the visceral and parietal pericardial layers.
39. The figure represents total period of one cardiac cycle, i.e., 0.8 sec and A, B and C represent its stages. Identify A, B and C and select the correct statement regarding them.
- 
- (a) During A, pressure within ventricles rises closing both bicuspid and tricuspid valves.
 (b) During B, bicuspid and tricuspid valves close producing first heart sound.
 (c) During C, blood is forced into the ventricles due to opening of both the valves.
 (d) During B, the atria contract due to a wave of contraction stimulated by SA node.
40. Select the correct statements regarding continuous ambulatory peritoneal dialysis (CAPD).
 I. This method is less time-consuming, but is quite expensive.
 II. Peritoneum is used as the dialyzing membrane instead of cellophane sheet.
 III. Semipermeable membrane used in this technique, permits slow transfer of substances.
 (a) Only I (b) I and III
 (c) II only (d) II and III



Key is published in this issue. Search now! ☺

SELF CHECK



Check your score! If your score is

No. of questions attempted

No. of questions correct

Marks scored in percentage

> 90%

90-75%

74-60%

< 60%

EXCELLENT WORK !

GOOD WORK !

SATISFACTORY !

NOT SATISFACTORY !

You are well prepared to take the challenge of final exam.

You can score good in the final exam.

You need to score more next time.

Revise thoroughly and strengthen your concepts.

CONCEPT MAP

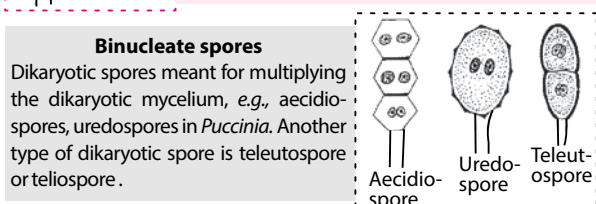
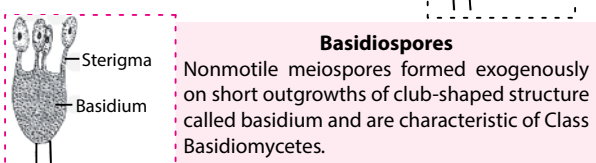
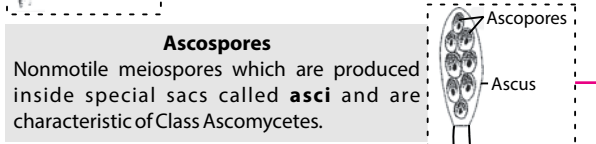
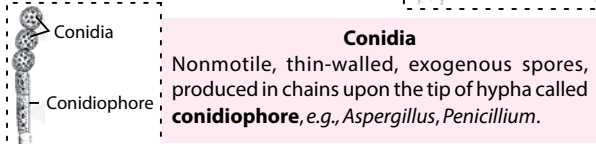
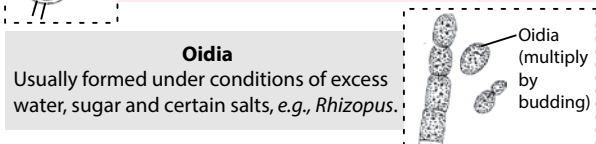
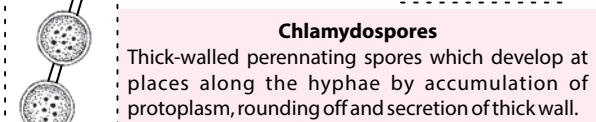
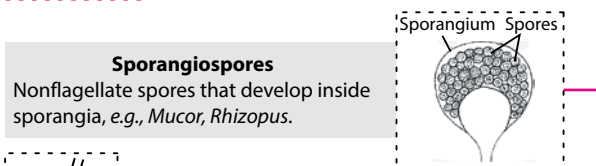
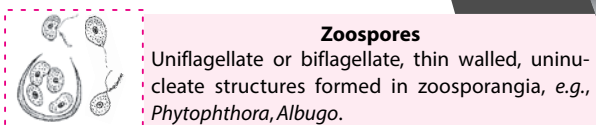
KINGDOM FUNGI

Fungi is a large kingdom comprising of about 5100 genera and more than 50,000 species. They are achlorophyllous, heterotrophic, spore forming, eukaryotic organisms with thalloid body made up of hyphae (together constituting mycelium). They are **cosmopolitan** in distribution. Some fungi occur in fresh or marine water, others are terrestrial and still others are air borne. The study of fungi is known as **mycology**.

NUTRITION

- They may be **obligate parasites** (obtain food from host plants and die with the death of host) or **facultative saprophytes** (usually parasitic but able to absorb food from decaying host plant as well), **obligate saprophytes** (obtain food from decaying organic matter) or **facultative parasites** (usually saprophytes but can live parasitically under some conditions).

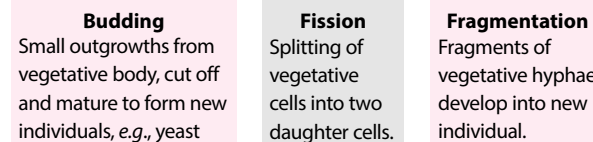
Asexual



REPRODUCTION

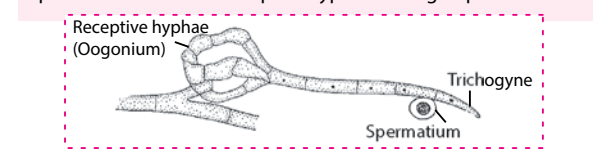
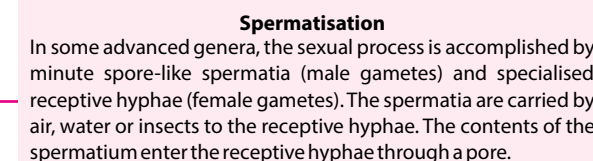
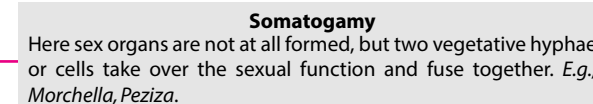
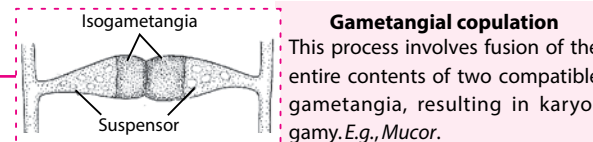
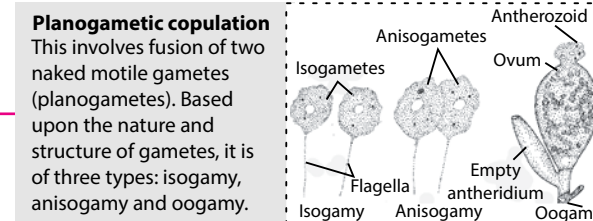
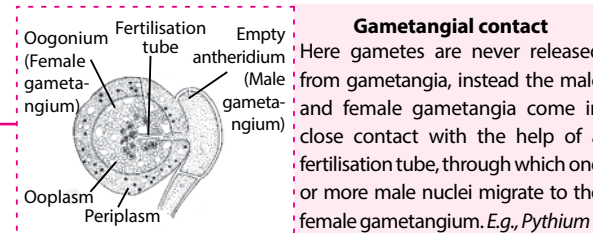
- Fungi may reproduce by vegetative, asexual and sexual means.

Vegetative



Sexual

Sexual reproduction takes place by following processes:



CLASSIFICATION

- Many botanists have classified fungi in different ways.
- Martin's** (1961) classification of fungi is most prevalent. He classified fungi into Myxomycotina (Slime molds) and Eumycotina (True fungi). Martin further divided Eumycotina into the following classes:

STRUCTURE

- Fungi range from unicellular, uninucleate forms like yeast and *Synchytrium* to thread-like structure called **mycelium** which is made up of a net like mass of tubular filaments called **hyphae**. The hypha is usually branched, tube like structure, having protoplasm with reserve food and bounded by a wall of **chitin**, a nitrogen containing polysaccharide $(C_{22}H_{54}N_4O_{21})_n$.
- The protoplasm of the hypha may be continuous without cross walls, called **aseptate hypha** or may have transverse partitions or septa, known as **septate hypha**. Septa are seldom complete as they are perforated and may contain plasmodesmata or central pores. When central septal pore possesses a barrel-shaped inflation, as in many basidiomycetes, it is known as **dolipore septum**.
- A membranous vesicle called **lomasome** is found attached to plasma membrane.

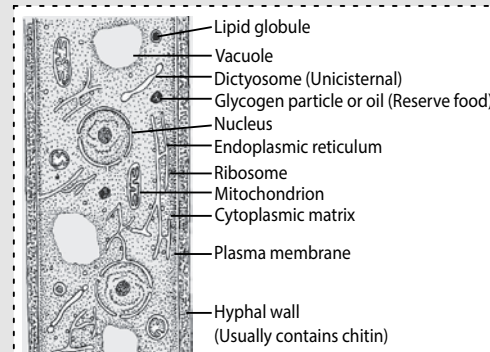


Fig.: Ultrastructure of part of fungal hypha

- In some fungi, hyphae may structurally modify in response to functional needs as:
 - Prosenchyma** : It is formed when the component hyphae lie more or less parallel to one another and unite to form a rather loosely interwoven structure where their individuality is not lost.
 - Pseudo-parenchyma** : It is formed when the hyphae become closely intertwined, forming a tissue which consists of hollow tubes spread in all directions. These lose their individuality.
 - Rhizomorph** : It is a thick strand or root-like aggregation of somatic hyphae which lose their individuality. The entire mass behaves as an organised unit and have higher infection capacity.
 - Sclerotium** : It is a compact globose structure, formed by the aggregation and adhesion of hyphae.
 - Appressorium** : It is a terminal, simple or lobed, swollen structure of germ tubes or infecting hyphae, found in many parasitic fungi.
 - Haustorium** : These are intracellular, absorbing structures of obligate parasites meant for absorbing food material from the host. They may be variously shaped and secrete specific hydrolysing enzymes.

Phycomycetes

- The mycelium is aseptate and coenocytic.
- The sporangia has innumerable sporangiospores (zoospores or aplanospores) formed endogenously.
- Sexual reproduction is oogamous in Oomycetes, and isogamous in Zygomycetes.
- Biflagellate motile cells (zoospores) are produced by many species.
- The zygote is unicellular and simple.
- E.g., *Albugo*, *Phytophthora* (Oomycetes), *Rhizopus*, *Mucor* (Zygomycetes).

Ascomycetes

- The mycelium consists of septate hyphae, possessing central or septal pores. Motile structures do not occur in the life cycle.
- In majority of Ascomycetes, the common mode of asexual reproduction is through the formation of conidia.
- Sexual reproduction takes place through fusion of sex cells, somatic cells, gametangial contact between an antheridium and ascogonium and autogamy.
- Karyogamy is delayed after plasmogamy. Hence, a new transitional phase called dikaryophase appears in the life cycle. The cells of dikaryophase are called dikaryotic cells as each cell possesses two nuclei $(n + n)$.
- Some dikaryotic cells function as ascus mother cells. **Ascus** is a sporangial sac peculiar to Ascomycetes. 4-8 haploid meiospores named ascospores are produced internally in each ascus.
- The asci may occur freely or get aggregated with dikaryotic mycelium to form fructifications called **ascocarps**.
- E.g., *Yeast*, *Aspergillus*, *Penicillium*, *Claviceps*, morels and truffles.

Basidiomycetes

- Basidiomycetes are the most advanced fungi and considered among the best decomposers of wood.
- Motile structures or cells are absent. Mycelia are of two types, primary and secondary.
- Karyogamy is delayed after plasmogamy. A new transitional phase called dikaryophase appears in the life cycle. It produces dikaryotic secondary mycelium. Secondary mycelium is long lived, profusely branched septate hyphae possessing dolipores.
- Hook-shaped outgrowths called **clamp connections** are found on the sides of septa which are meant for proper distribution of dikaryons at the time of cell division.
- Karyogamy and meiosis occur in club-shaped structures known as **basidia**. A basidium commonly produces four meiospores or basidiospores exogenously at the tip of fine outgrowths called **sterigmata**.
- The fungi may or may not produce fructifications called **basidiocarps** that vary in size from microscopic to macroscopic forms.
- E.g., *Puccinia*, *Ustilago*, *Agaricus*, bracket fungi, etc.

Deuteromycetes

- Deuteromycetes is an artificial class of fungi which has been created to include all those fungi in which sexual stage is either absent or not known.
- Some of the deuteromycetes are unicellular like yeast.
- The mycelium is usually septate. Coenocytic forms are not known.
- Asexual reproduction often occurs by conidia along with some other types of spores.
- It is believed that most members of deuteromycetes are actually ascomycetes in which sexual reproduction is either absent or yet to be discovered.
- E.g., *Colletotrichum*, *Helminthosporium*, *Trichoderma*.



NEET ESSENTIAL

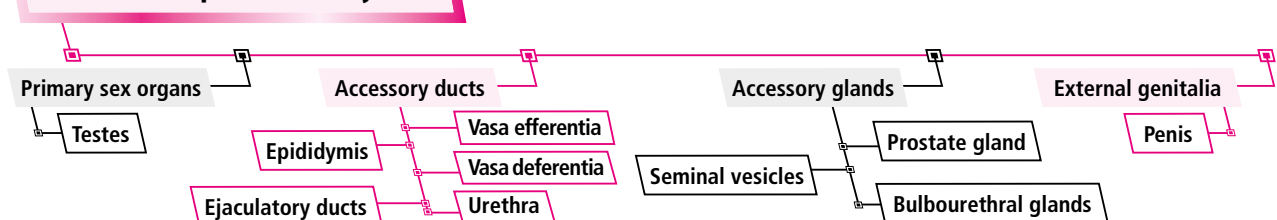
The syllabus for NEET is very vast which impedes students from acquiring indepth knowledge and covering the entire syllabus at the same time. An essential topic for NEET is therefore presented here to enable students grasp the topic, analyse the type of questions and SCORE HIGH.

HUMAN MALE REPRODUCTIVE SYSTEM

Humans exhibit sexual dimorphism, *i.e.*, male and female individuals are differentiated externally. Both male and female reproductive systems have evolved according to their respective functions and contributions in the events of human reproduction. The male reproductive system comprises of :

- **Primary sex organs**, *i.e.*, testes that produce gametes as well as sex hormones.
- Accessory ducts which play an important role in storage and transport of male gametes.
- Accessory glands which include a pair of seminal vesicles, a pair of bulbourethral glands (Cowper's gland) and one prostate gland.
- External genitalia which includes penis.

The Male Reproductive System



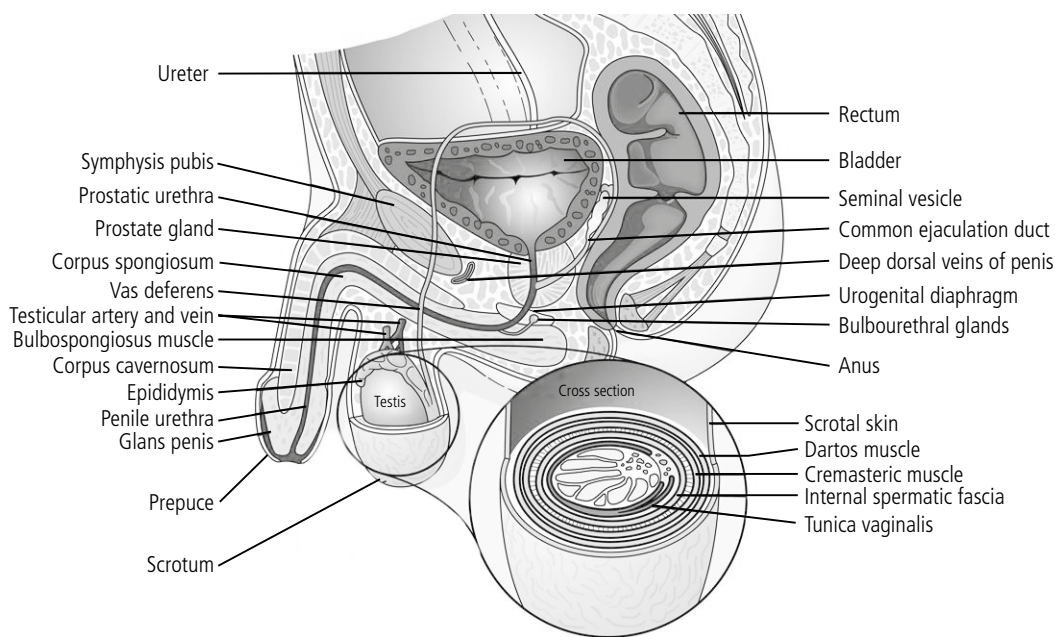


Fig.: Lateral view of male reproductive system

SCROTUM

- The scrotum is a dual-chambered sack of skin and muscles suspended from groin which contains the testes and some of the male sex accessory ducts. It is homologous to the labia majora of females. It is an extension of the perineum and is located between the penis and anus. Underneath the skin of the scrotum is a layer of involuntary smooth muscle, the tunica dartos. Just under it another layer of muscle is present the cremaster which is a voluntary striated muscle. Scrotum remains connected with the abdomen or pelvic cavity by **inguinal canals**. Spermatic cord passes into the testis through inguinal canal.

Function

- The main purpose of scrotum is to provide appropriate temperature for optimal sperm production. The scrotum maintains the testes at around 34°C , i.e., a temperature slightly lower than the core body temperature (37°C) as high temperature hampers the development of sperms. Temperature receptors are located in the scrotum. The temperature is controlled by scrotal movement of the testes away or towards the body depending on the environmental temperatures. Moving the testes away from the abdomen and increasing the exposed surface area allow a faster dispersion of excess heat. This is done by means of contraction and relaxation of the cremaster muscle and the dartos muscle in the scrotum. In case the temperature drops, the movement of scrotum towards the pelvic cavity allows the testes to absorb heat from the rest of body so that they do not get chilled.

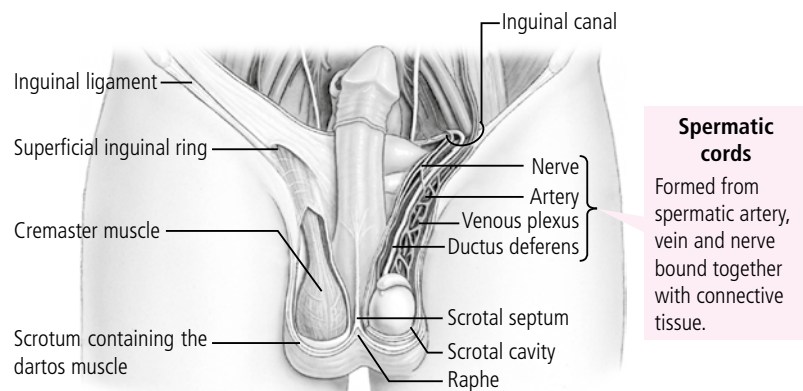


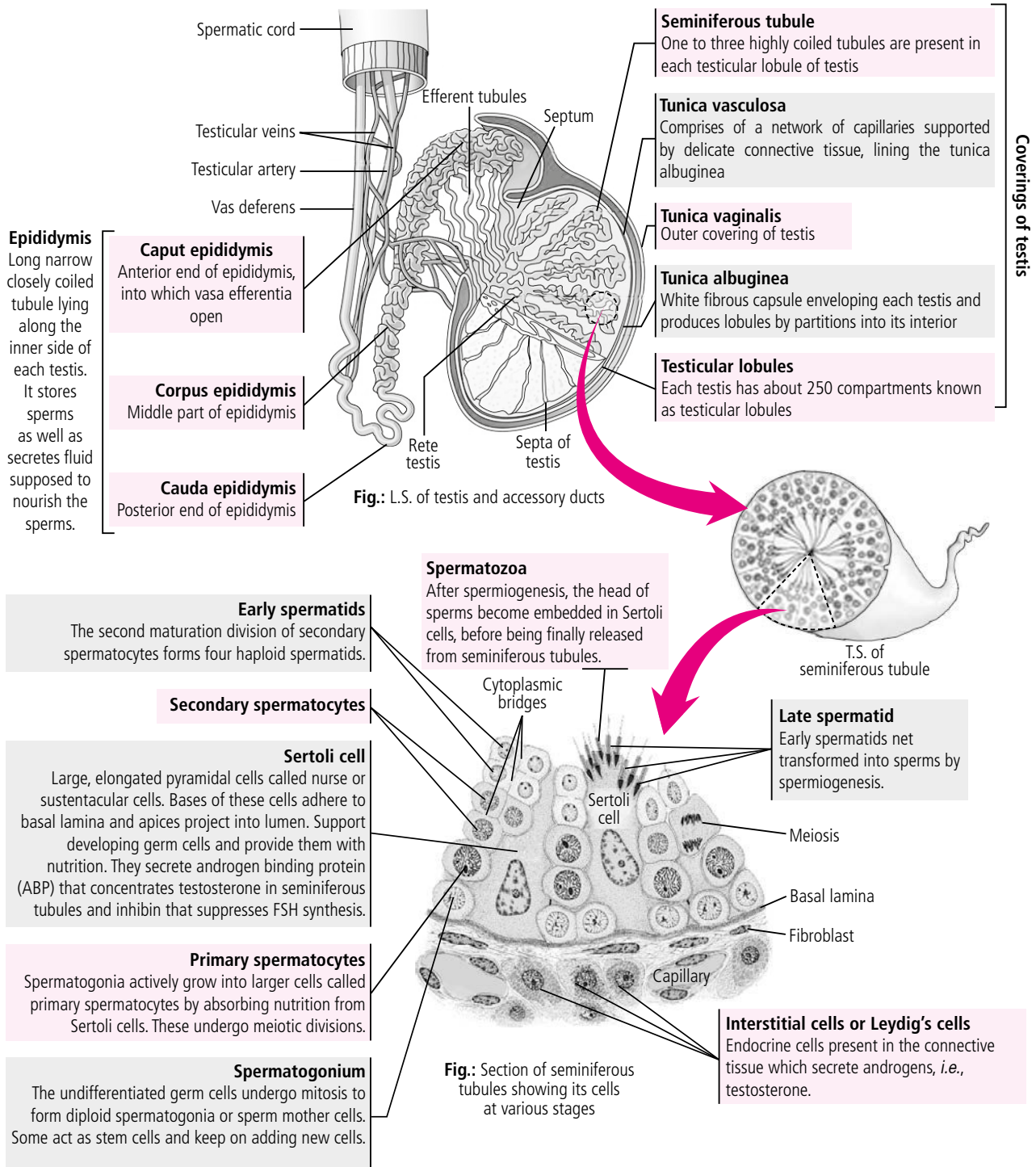
Fig.: Scrotum with a portion of covering removed to display testis and related structures

In humans, temperature regulation is not the only function of scrotum. It also prevents the testes from being subjected to various abdominal pressures that may be exerted by the abdominal muscles (if testes were present in abdominal cavity) and thereby prevents rapid emptying of both testes and epididymes before maturation of sperms.

However, some mammals like elephants and marine mammals retain testes in abdomen but they have special mechanisms to prevent inadvertent emptying.

TESTES : THE PRIMARY MALE SEX ORGANS

Testes are the components of both reproductive system and endocrine system and thus are homologous to ovaries. Though they develop in the abdominal cavity during early fetal life, they (testes) descend into the scrotum through inguinal canals and remain suspended in it by spermatic cords. The fibrous cord that extends from the caudal end of the testis to the scrotal wall is called **gubernaculum**. Each testis is oval in shape with a length of about 4-5 cm and width of about 2-4 cm. The peritoneum called **mesorchium** supports the testis. **Testes produce sperms (by spermatogenesis) and androgens (testosterone) at the time of puberty.**



REPRODUCTIVE DUCTS

The reproductive ducts include rete testis, vasa efferentia, epididymis, vas deferens, urethra and ejaculatory ducts.

Rete Testis

The seminiferous tubules from different areas of a testis converge to form a network of interconnected tubes, the **rete testis**.

Vasa Efferentia

These are fine ciliated ductules that arise from the rete testis. They vary from 15-20 in number and carry sperms from rete testis to the epididymis.

Epididymis

It is loosely attached to the outside of testes. It is a long, narrow, highly coiled tubule which when straightened out measures approximately 6m. It is differentiated into three parts, *i.e.*, caput epididymis, corpus epididymis and cauda epididymis.

Function

It is involved in storage, nutrition and physiological maturation of the sperms. It also shows peristaltic contractions to move the sperms.

Vasa Deferentia

It is a long, narrow, muscular and tubular structure that starts from cauda epididymis, ascends and passes through inguinal canal, over the urinary bladder in abdomen and finally joins the duct from seminal vesicle to form ejaculatory duct.

Function

It conducts sperms through peristalsis.

Ejaculatory Ducts

These are two short tubes formed by the union of a duct from seminal vesicles and vas deferens. They are composed of fibrous, muscular and columnar epithelial tissue. Each of these duct pass through prostate gland and joins the urethra.

Function

These ducts carry sperms and secretion of seminal vesicles to urethra.

Urethra

It arises from the urinary bladder and joins the ejaculatory duct to form urinogenital canal. It is differentiated into three parts:

- **Prostatic urethra** : The first part of urethra surrounded by prostate gland, that arises from urinary bladder and carries urine only.
- **Membranous urethra** : It is the smallest part of urethra and is present behind the lower part of pubic symphysis.
- **Penile urethra** : The part of urethra that opens at the tip of penis as **urethral meatus**, (external opening).
- It comprises of two urethral sphincters.

The **internal sphincter** consists of smooth muscle fibres situated at the neck of the bladder above the prostate gland. The **external sphincter** consists of striated muscle fibres surrounding the membranous part of the urethra.

Function

It provides a common passage for semen and urine.

Male v/s Female urethra

The urethra in males is much longer, *i.e.*, approx. 20 cm in length as compared to females (4 cm). Being long it is differentiated into three regions in males while it remains undifferentiated in females. It carries both urine and semen in males but passes only urine in females.

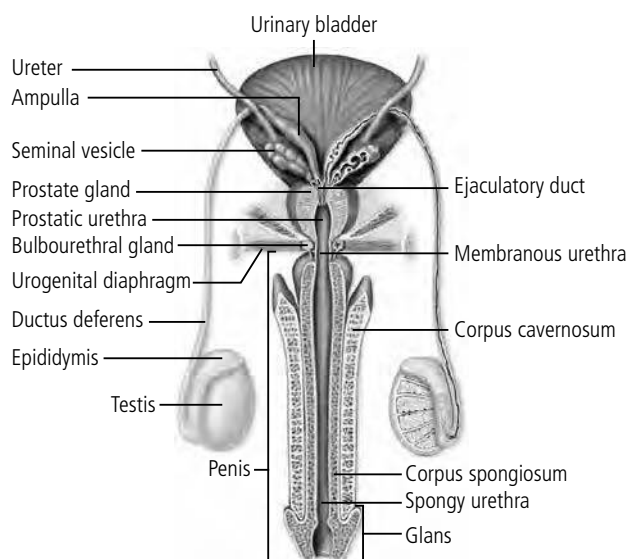


Fig.: Front view of male reproductive system

External Genitalia : Penis

It is the male copulatory organ and serves both as a reproductive organ and urinal duct. Unlike other species, human penis has no baculum or erectile bone and is larger than that of any other primate, in relation to proportion of body mass. It is made up of three columns of tissue.

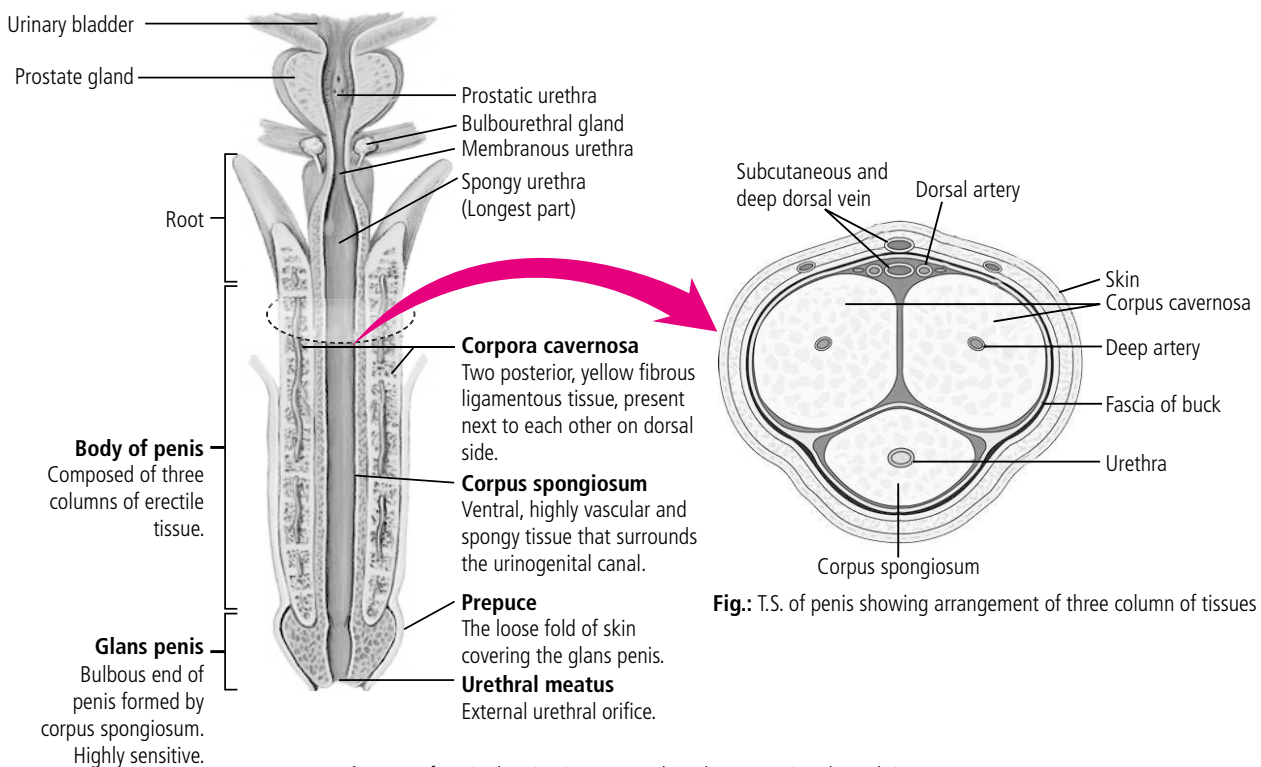


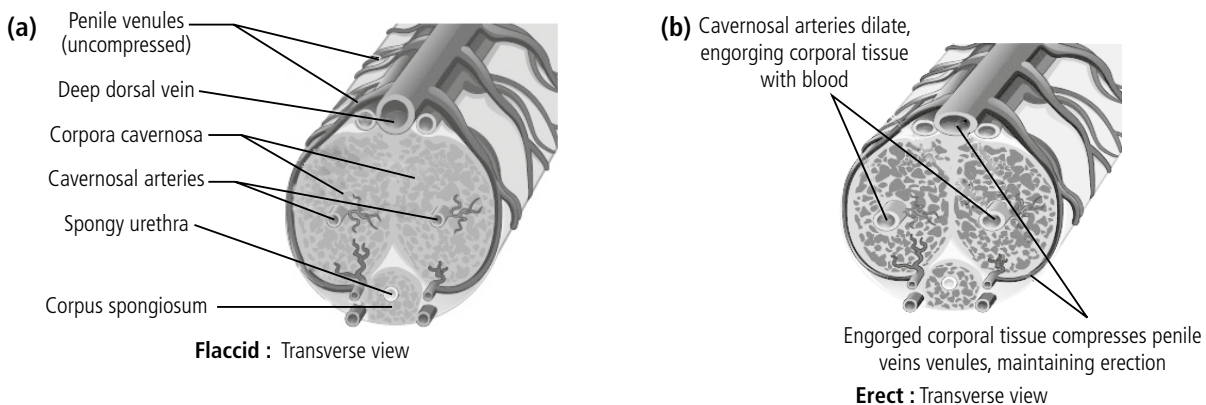
Fig.: T.S. of penis showing arrangement of three column of tissues

Fig.: L.S. of penis showing its parts and urethra traversing through it

Function : Penis helps in sexual intercourse and insemination. This involves following three phases:

Erection of penis

An erection refers to the stiffening and rising of the penis that is often associated with sexual arousal. It occurs due to the autonomic dilation of arteries supplying blood to the penis. This allows more blood to fill the three spongy erectile tissue chambers in the penis, causing it to lengthen and stiffen. The engorged erectile tissue presses against and constricts the veins that carry blood away from the penis. More blood enters than leaves the penis until an equilibrium is reached where an equal volume of blood flows into the dilated arteries and out of the constricted veins; a constant erectile size is achieved at this equilibrium.



Ejaculation

The penis is inserted into the vagina of female and the friction of rhythmic movements of penis stimulates the release of semen into urethra (referred to as emission). The wave-like contractions of muscles at the base of penis cause forceful discharge of semen from urethra into the vaginal canal and is called ejaculation. It is usually the result of sexual stimulation, including prostate stimulation. However, it may occur spontaneously during sleep, also known as "wet dream".

Subsidence of Erection

After ejaculation, the arterioles to the penis contract, reducing the flow of blood to penis. This gradually subsides erection of penis.

ACCESSORY GLANDS

The secretions of accessory glands produce seminal fluid as well as lubricate the urethra. These glands are seminal vesicles, prostate gland, bulbourethral or Cowper's glands.

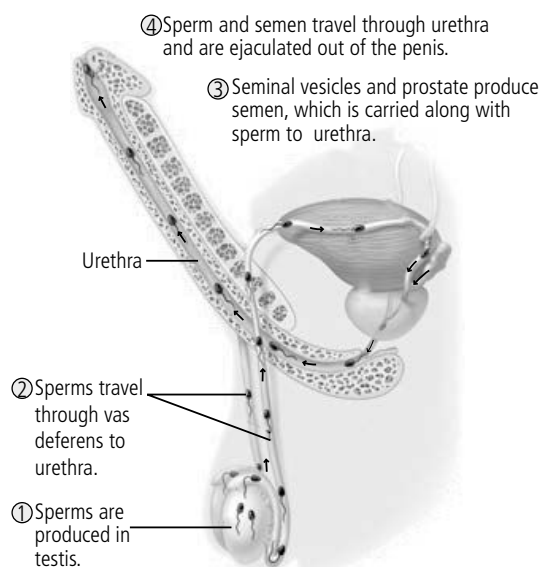


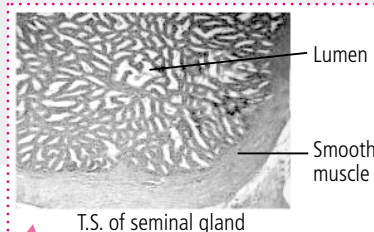
Fig.: Passage of sperms during ejaculation

Seminal Vesicles

- These are a pair of elongated (5 cm), muscular and sacculated glands situated in the pelvis between the bladder and rectum. The ducts of seminal gland join the vasa deferentia to form ejaculatory ducts.
- Function** : They produce an alkaline secretion that forms about 60-70% of the volume of semen. The pH of seminal fluid is 7.4. It helps to neutralise the acidity of male urethra as well as vaginal tract, thus prolonging the lifespan of sperms.

Secretion of seminal vesicles

- Fructose** : Provide energy for the sperms.
- Prostaglandins** : Stimulate uterine contractions that help the sperm to propel towards female's oviduct.
- Clotting proteins** : Facilitates coagulation of semen after ejaculation.



T.S. of seminal gland

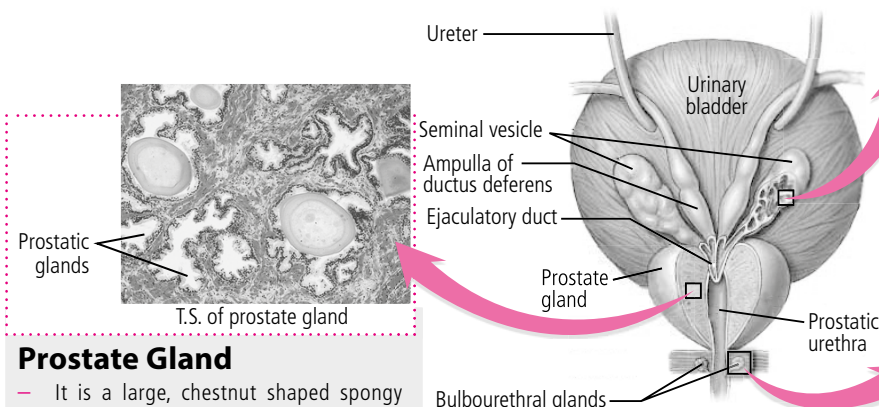


Fig.: Accessory glands of male reproductive system

Prostate Gland

- It is a large, chestnut shaped spongy and lobulated gland which surrounds the proximal part of urethra. It remains sheathed in the muscles of pelvic floor. It pours its alkaline secretion into urethra by 20-30 openings.
- Function** : Prostate produces a slightly acidic milky fluid with pH of 6.5, constituting 20-30% of the volume of semen. It contains citric acid, enzymes (acid phosphatase, amylase, etc.), and prostaglandins. Its secretion nourishes and activates the spermatozoa to swim.

Secretion of prostate

- Citric acid** : Acts as a nutrient for sperm and imparts acidity to fluid.
- Enzymes** : Like acid phosphatase, amylase, pepsinogen, etc.
- Prostaglandins** : Activates the sperms to swim.

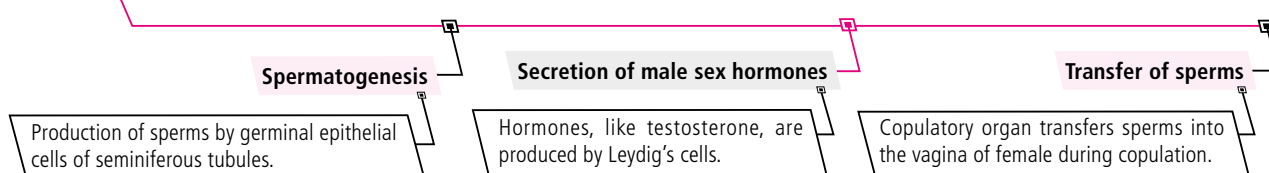
Bulbourethral Glands or Cowper's Glands

- These are paired, pea sized tubuloalveolar glands present on either side of membranous urethra. Its ducts open into the urethra.
- Function** : These glands secrete an alkaline fluid, which neutralises the acidity of urine in urethra. They secrete mucus which lubricates the penis for frictionless movements during copulation.

Semen

Secretion of the male accessory glands, i.e., seminal vesicles, prostate gland and Cowper's glands and sperms from testes collectively constitute the semen. The pH of semen varies between 7.35 to 7.50. It is rich in fructose, citric acid, prostaglandins, clotting proteins and certain enzymes. It is ejected from the penis during ejaculation. A single ejaculation may contain 200-300 million sperms, of which 60% should have normal shape and size while rest 40% must show vigorous motility for normal fertility. The fluid part of semen is called seminal plasma. It maintains the viability and motility of sperms and provides proper pH and ionic strength.

Functions of Male Reproductive System



Spermatogenesis

This refers to the formation of haploid functional male gametes (spermatozoa) from the diploid reproductive cells (spermatogonia). It occurs in the seminiferous tubules of the testes.

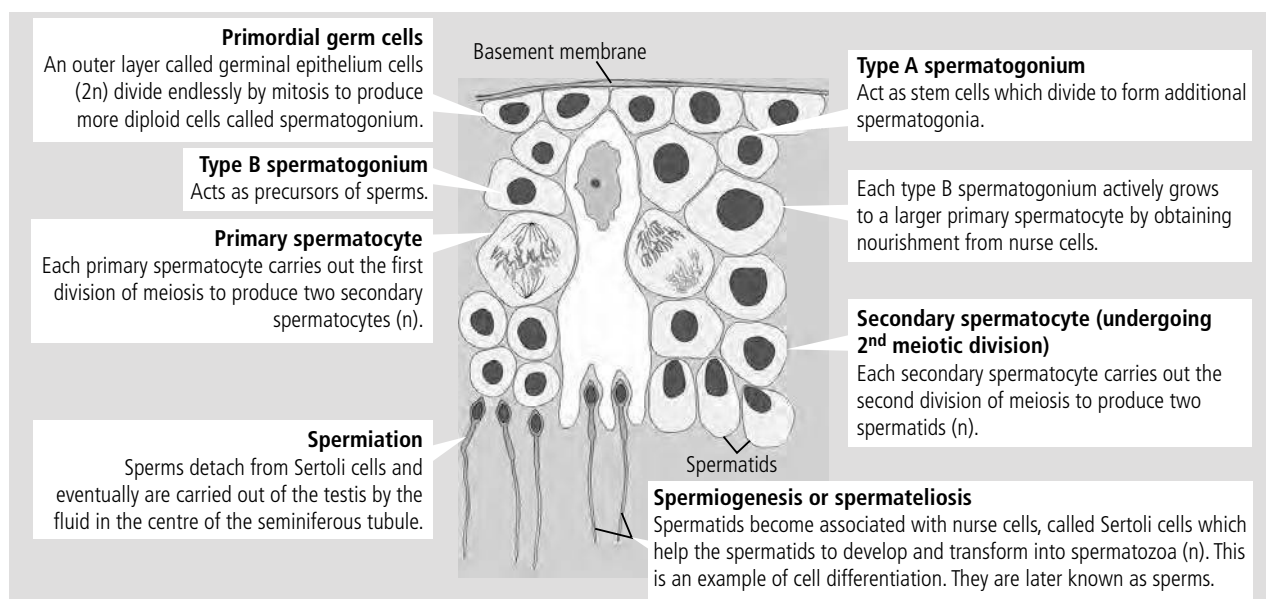


Fig.: Cells of seminiferous tubules undergoing spermatogenesis

UNSCRAMBLED WORDS

NOVEMBER 2017

- | | |
|--------------------|--------------------|
| 1-i- LEPTOCEPHALUS | 2-e- TOTIPOTENCY |
| 3-a- INVOLUCRE | 4-j- PERICHONDRIUM |
| 5-b- PHYTOALEXINS | 6-g- ISCHAEMIA |
| 7-f- MALACOPHILY | 8-d- DIAPHRAGM |
| 9-h- CYCLOSPORIN | 10-c- NOSEMA |

Winners : Ananda Lekshmi T (Vellore), Kelvin Joseph (Mumbai), Meenakshi Sharma (Himachal Pradesh), Anchitha Palleri (Kerala), Manisha Singh (Varanasi)

Spellingathon Winners

November-2017

- Prabhukalyan Mohapatra
- Bhubaneshwar
- Tanvi Salins - Udupi, Karnataka

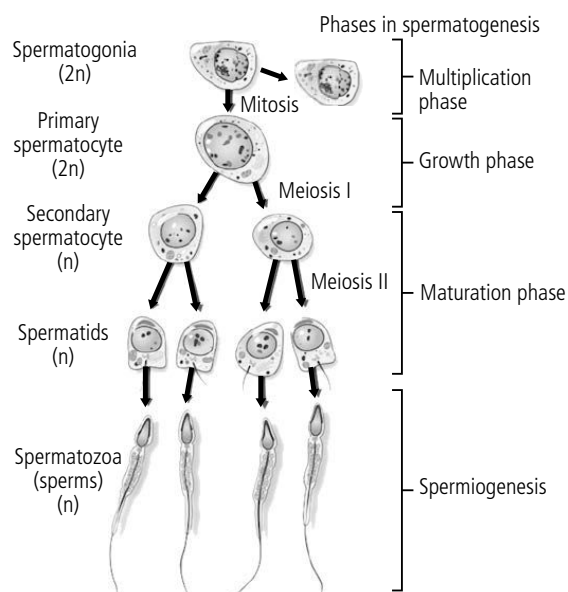


Fig.: Events in spermatogenesis

Significances of Spermatogenesis

- Each spermatogonium produces four haploid sperms, having half the number of chromosomes.
- Fertilisation of haploid gametes restores the diploid number of chromosomes in zygote. Thus, spermatogenesis maintains chromosome number of species.
- Crossing over takes place during meiosis I, which brings about variations.

Spermiogenesis

The transformation of spermatids into spermatozoa is called **spermiogenesis** or **spermateliosis** or differentiation phase.

- The different changes occurring during spermiogenesis are:
 - Formation of **acrosome by Golgi apparatus**
 - Elongation of nucleus**
 - Separation of centrioles**
 - Formation of **axial filament from distal centriole**
 - Development of **mitochondrial spiral** around upper parts of axial filament
 - Formation of flagellum**

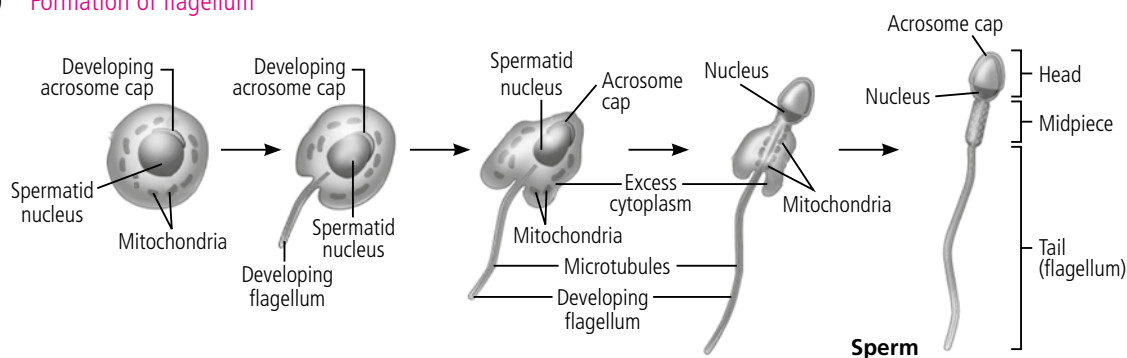


Fig.: Stages in spermiogenesis

- The entire process of spermatogenesis, from primary spermatocytes to mature spermatozoa (sperms) approximately takes **64 days in man**. The normal human male manufactures nearly 200-290 million sperms per day. A very high rate of sperm production appears to be necessary to overcome the odds against internal fertilisation.

Spermiation

After their maturation, spermatozoa detach from the Sertoli cells and the process is called **spermiation**. The released sperms are stored in epididymis and first portion of vasa deferentia for few weeks. **Here, they gain motility. Nutrition is provided by epithelium of epididymis.**

Sperm

These are microscopic and motile cells that remain alive and retain their ability to fertilise an ovum from 24 to 48 hours, after being released in the female genital tract.

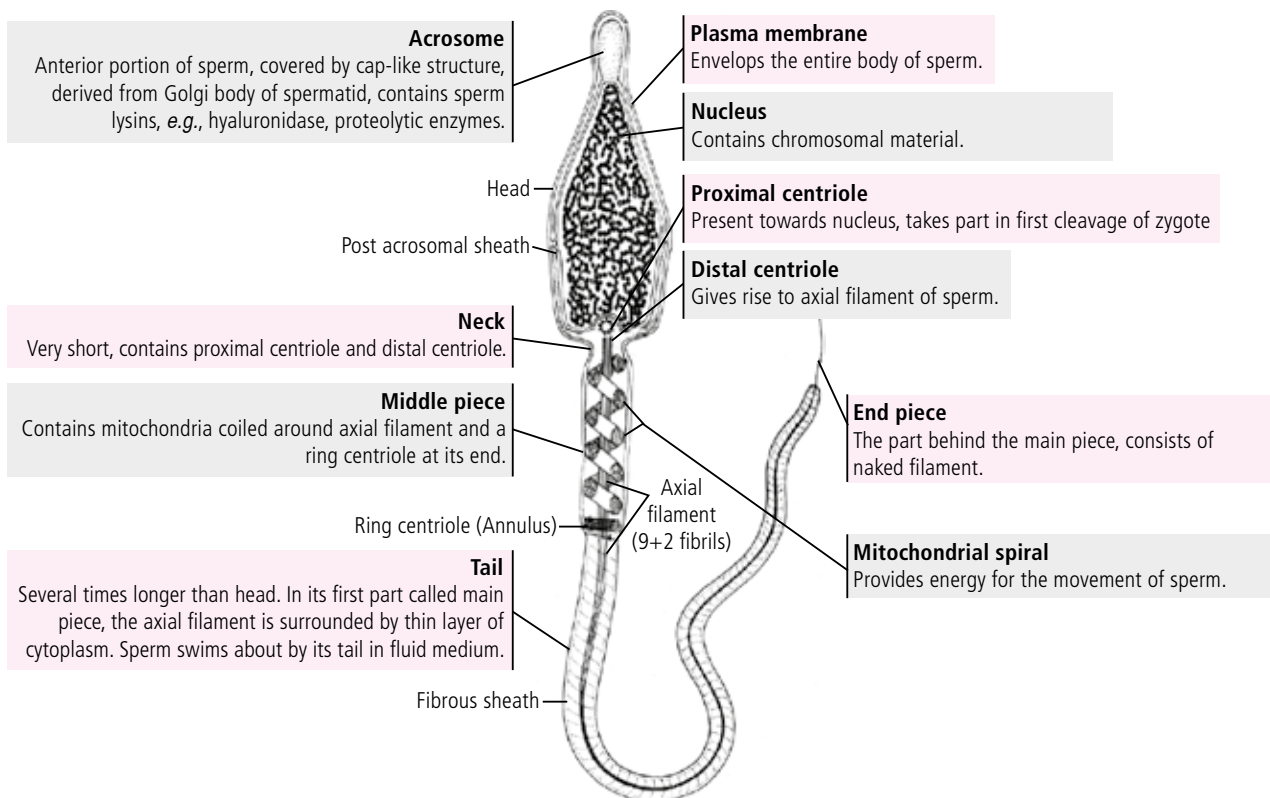
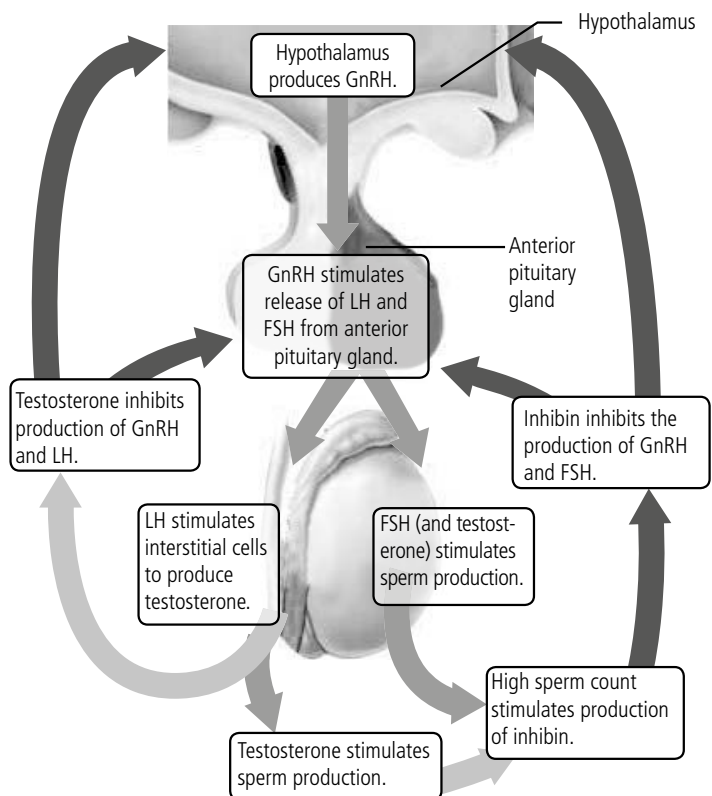
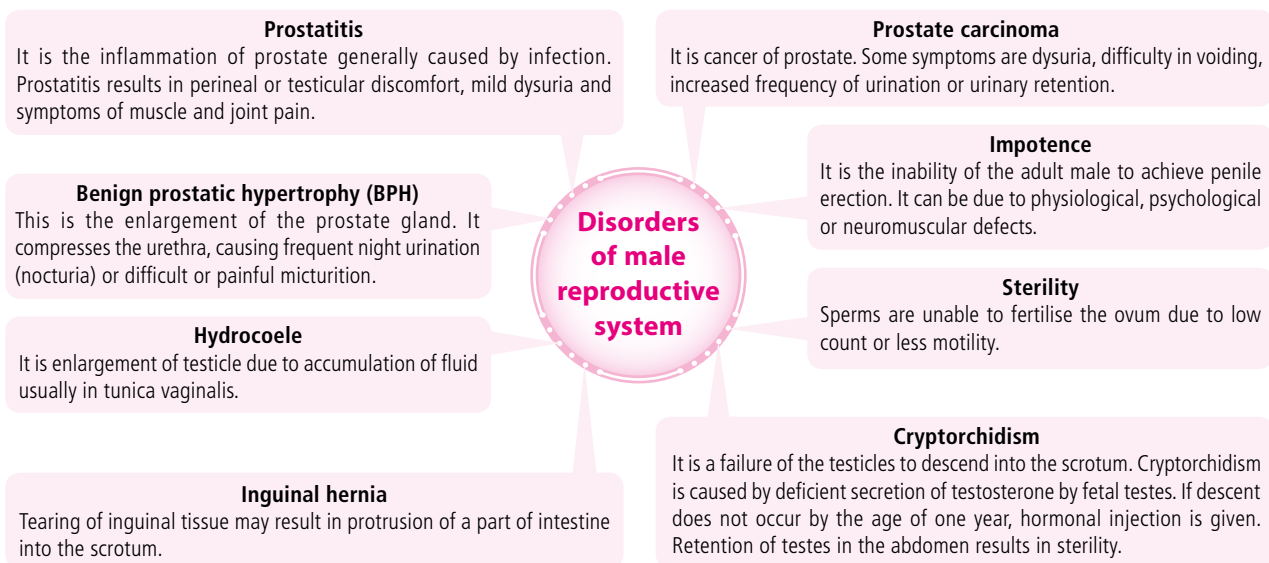


Fig.: Mammalian spermatozoan

HORMONAL CONTROL OF MALE REPRODUCTIVE SYSTEM

- Spermatogenesis starts in male only at puberty due to increased secretion of gonadotropin-releasing hormone from hypothalamus of brain.
- Though the gonadotropic hormones secreted by pituitary gland, i.e., FSH and LH are named so for their action in females, they both are also involved in regulating male reproductive functions also.
- LH stimulates the Leydig's cells to secrete **testosterone** and FSH stimulates the Sertoli cells to secrete **androgen binding protein (ABP)** and **inhibin**.
- Testosterone and inhibin, in turn exert negative feedback inhibition on the secretion of LH and FSH respectively.



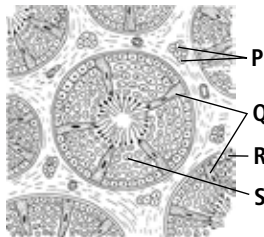


POWER EXERCISE

New MCQs

- Which of the following consists of haploid number of chromosomes?
(a) Spermatogonium (b) Primary spermatocyte
(c) Secondary spermatocyte (d) Sertoli cells
- Testes remain suspended in the scrotum by means of
(a) spermatic cords (b) inguinal canals
(c) gubernaculum (d) mesorchium.
- A fibrous cord that extends from caudal end of the testis to the scrotal wall is
(a) gubernaculum (b) mesorchium
(c) tunicae (d) spermatic cords.
- The middle piece of human sperm consists of
(a) centriole, mitochondria and 9 + 0 arrangement of microtubules
(b) nucleus and mitochondria
(c) 9 + 2 arrangement of microtubules only
(d) mitochondria and 9 + 2 arrangement of microtubules.
- Which of the following statements is incorrect?
(a) Sertoli cells provide nutrition to the developing male germ cells.
(b) Leydig's cells synthesise and secrete androgens.
(c) Secretions of the acrosome helps the sperm to enter into the cytoplasm of the ovum.
(d) Secondary spermatocytes are diploid.
- Manchette is a sheath covering the
(a) head and neck of sperm
(b) membranous urethra
(c) the end piece of tail of sperm
(d) half of nucleus, neck and middle piece of sperm.
- Identify the correct sequence of stage leading to formation of mature human sperms in testis.
(a) Spermatogonia → Spermatid → Spermatocyte → Sperms
(b) Spermatogonia → Spermatocyte → Spermatid → Sperms
(c) Spermatid → Spermatocyte → Spermatogonia → Sperms
(d) Spermatocyte → Spermatogonia → Spermatid → Sperms
- Cryptorchidism is a condition in which
(a) prostate gland gets enlarged
(b) male sterility takes place
(c) fluid is collected in tunica vaginalis of the testis
(d) testes do not descend into the scrotum.
- The most commonly used marker enzyme in clinical diagnosis of prostate cancer is
(a) anti fertilizin (b) spermlysins
(c) acid phosphatase (d) fertilizin.
- The main function of secretions of Cowper's gland is
(a) nourishment of sperms
(b) activation of sperms to swim
(c) lubrication of end of penis and urethral lining
(d) coagulation of semen.
- If vasa efferentia in male reproductive system gets blocked, the gametes will not be transported from
(a) epididymis to vas deferens
(b) testes to epididymis
(c) vasa efferentia to rete testis
(d) ejaculatory ducts to penis.

12. Read the following statements and select the correct option.
- ADAM (Androgen Deficiency in Ageing Males) is also called male menopause, normally occurs in men above the age of 50.
 - Testosterone is principal androgen which brings about the growth of the secondary sex organs and secondary sexual characters.
 - Semen has a pH of 7.35 to 7.50 so it is slightly alkaline.
 - In male LH is called interstitial cells stimulating hormone (ICSH), as it stimulates sertoli cells of the testes to secrete androgens.
- (a) I only (b) II and III
(c) III and IV (d) I and IV
13. The acrosome of human sperm is derived from
- (a) Golgi body (b) distal centriole
(c) ring centriole (d) mitochondria.
14. Select the correct option with a group of structures representing testis only.
- (a) Seminiferous tubules, interstitial cells, prostate gland
(b) Sertoli cells, Leydig's cells, vas efferentia
(c) Interstitial cells, seminiferous tubules, vas deferens
(d) Prostate gland, Leydig's cells, sertoli cell
15. Study the given figure showing T.S. of mammalian testis and identify the parts labelled as P, Q, R and S.

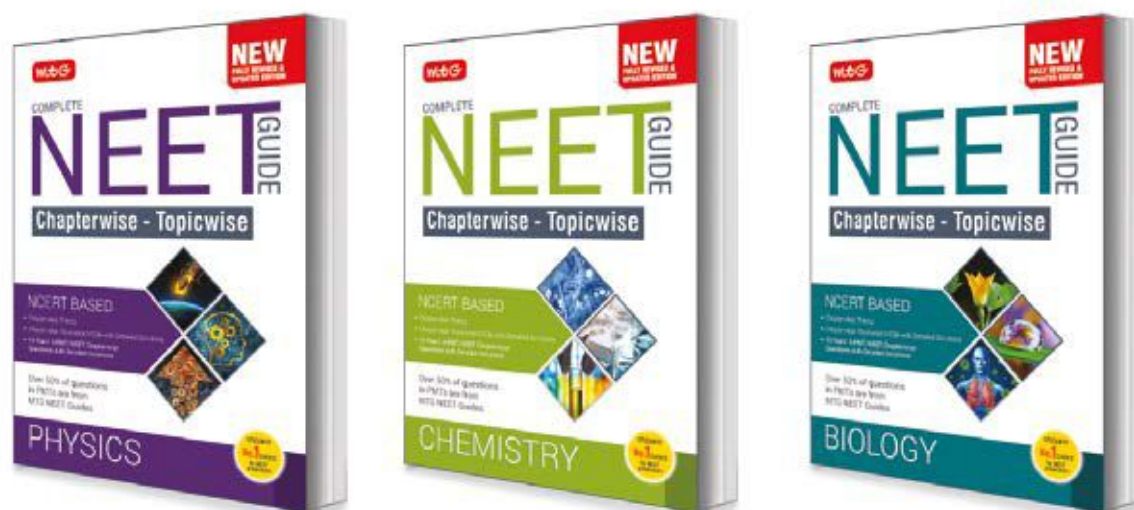


P	Q	R	S
(a) Leydig's cells	Sertoli cells	Germinal epithelium	Secondary spermatocyte
(b) Sertoli cells	Leydig's cells	Spermatogonium	Spermatids
(c) Leydig's cells	Sertoli cells	Primary spermatocyte	Spermatids
(d) Sustentacular cells	Leydig's cells	Spermatogonium	Primary spermatocyte

Exam Section

1. The spermiogenesis involves all of the following except
- (a) formation of mitochondrial sheath
(b) formation of proximal and distal centrioles
(c) formation of acrosome
(d) shortening of sperm. (MH CET 2017)
2. The prostatic fluid forms about _____ of total volume of semen.
- (a) 60% (b) 50%
(c) 40% (d) 30% (MH CET 2017)
3. Identify the correct statement on 'inhibin'.
- (a) Is produced by granulosa cells in ovary and inhibits the secretion of LH
(b) Is produced by nurse cells in testes and inhibits the secretion of LH
(c) Inhibits the secretion of LH, FSH and prolactin
(d) Is produced by granulosa cells in ovary and inhibits the secretion of FSH (NEET Phase-I 2016)
4. Which of the following depicts the correct pathway of transport of sperms?
- (a) Rete testis → Efferent ductules → Epididymis → Vas deferens
(b) Rete testis → Epididymis → Efferent ductules → Vas deferens
(c) Rete testis → Vas deferens → Efferent ductules → Epididymis
(d) Efferent ductules → Rete testis → Vas deferens → Epididymis (NEET Phase-II 2016)
5. Which one of these is not an accessory glands in male reproductive system?
- (a) Cowper's gland (b) Prostate gland
(c) Bartholin's gland (d) Seminal vesicle (Karnataka CET 2016)
6. The Leydig's cells found in the human body are the secretory source of
- (a) glucagon (b) androgens
(c) progesterone (d) intestinal mucus. (J & K CET 2015)
7. How many days does it take for spermatogenesis to take place?
- (a) 40 to 65 days (b) 60 to 75 days
(c) 70 to 95 days (d) 50 to 65 days (UP CPMT 2015)
8. Vasa efferentia are muscular tubes, each of which connects
- (a) an epididymis to vas deferens
(b) vas deferens to seminal vesicle
(c) rete testis to vas deferens
(d) rete testis to epididymis. (JIPMER 2014)
9. The release of sperms from the seminiferous tubules is called
- (a) spermiogenesis (b) spermiation
(c) spermatogenesis (d) fertilisation
(e) gametogenesis. (Kerala PMT 2014)
10. Starting from the maximum, arrange the following male reproductive accessory organs in the correct order, based on the amount of secretion.
- (i) Prostate gland
(ii) Seminal vesicle
(iii) Bulbourethral gland
- (a) (i) > (ii) > (iii) (b) (iii) > (ii) > (i)
(c) (ii) > (iii) > (i) (d) (ii) > (i) > (iii) (AIIMS 2013)

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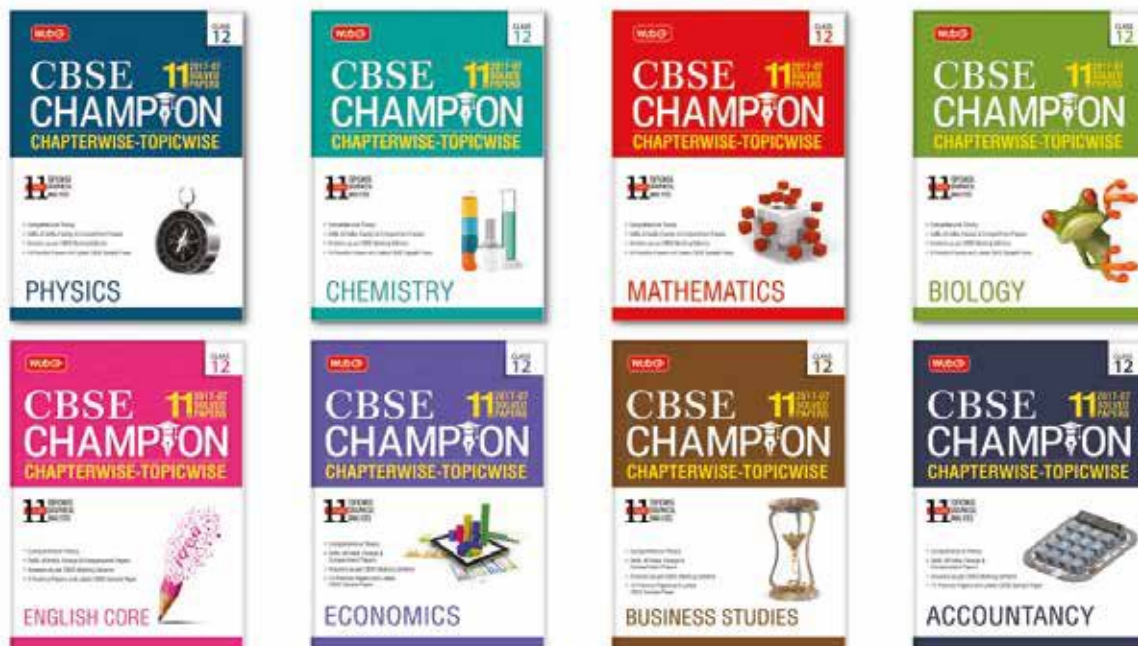


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11. Which one of the following statements is not true with respect to viability of mammalian sperm?
- Viability of sperm is determined by its motility.
 - Sperms must be concentrated in a thick suspension.
 - Sperm is viable for only upto 24 hours.
 - Survival of the sperm depends on the pH of the medium and it is most active in alkaline pH.

(J & K CET, AIPMT Prelims 2012)

12. The testes in humans are situated outside the abdominal cavity inside a pouch called scrotum. The purpose served is for
- maintaining the scrotal temperature lower than the internal body temperature
 - escaping any possible compression by the visceral organs
 - providing more space for the growth of epididymis
 - providing a secondary sexual feature for exhibiting the male sex.

(AIPMT Prelims 2011)

13. Secretions from which one of the following are rich in fructose, calcium and some enzymes?
- Male accessory glands
 - Liver
 - Pancreas
 - Salivary glands

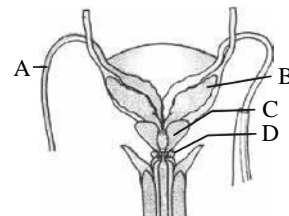
(AIPMT Mains 2010)

14. Sertoli cells are found in
- ovaries and secrete progesterone
 - adrenal cortex and secrete adrenaline

- seminiferous tubules and provide nutrition to germ cells
- pancreas and secrete cholecystokinin.

(AIPMT Prelims 2010)

15. Given below is a diagrammatic sketch of a portion of human male reproductive system. Select the correct set of the names of the parts labelled A, B, C and D.



- A-vas deferens, B-seminal vesicle, C-prostate, D-bulbourethral gland
- A-vas deferens, B-seminal vesicle, C-bulbourethral gland, D-prostate
- A-ureter, B-seminal vesicle, C-prostate, D-bulbourethral gland
- A-ureter, B-prostate, C-seminal vesicle, D-bulbourethral gland

(AIPMT 2009)

Assertion & Reason

The following questions consist of two statements each : assertion (A) and reason (R). To answer these questions, mark the correct alternative as directed below :

- If both A and R are true and R is the correct explanation of A.

UNSCRAMBLE ME

Unscramble the words given in column I and match them with their explanations in column II.

Column I

- ENROTPIA
- LITISCOBIS
- DAXECU
- OHALDNICR
- TETUELBN
- YPERHTURM
- DISIAI
- SPYCIRS
- HADIAYPGS
- OSEEPMI

Column II

- Superficial outgrowths of lichens, primarily meant for increasing surface area and photosynthetic activity.
- A condition characterised by difficulty in swallowing.
- A crystalline alkaloid obtained from deadly nightshade plant used for dilating the pupil during eye examinations.
- A genetic element that can replicate independently of its host cell's chromosome or as a part of chromosomes.
- Unbranched, erect and stout cylindrical stem having scars and remnants of fallen leaves.
- A mild CNS stimulant containing alkaloid arecoline which stains the teeth and gum red.
- Natural insecticides obtained from the *Chrysanthemum* plant that is used in mosquito coils and fly sprays.
- A trait showing inheritance only from father to son.
- A technique in which gold particles coated with foreign DNA are bombarded into target cells at a very high velocity.
- The ability of an animal that helps it to camouflage in natural environment.

Readers can send their responses at editor@mtg.in or post us with complete address by 25th of every month to win exciting prizes. Winners' names will be published in next issue.

- (b) If both A and R are true but R is not the correct explanation of A.
 (c) If A is true but R is false.
 (d) If both A and R are false.

1. **Assertion** : Sertoli cells concentrate testosterone in the seminiferous tubules.

Reason : Sertoli cells secrete androgen binding protein.

2. **Assertion** : Vasa efferentia arise as fine ciliated ductules from rete testis.

Reason : Vasa efferentia carry sperms from cauda epididymis to ejaculatory duct.

3. **Assertion** : The presence of fructose in female's genital tract confirms sexual intercourse.

Reason : Secretions of seminal vesicles contain fructose, hormones and clotting proteins.

4. **Assertion** : During maturation phase of spermatogenesis, the spermatids get transformed into mature sperms.

Reason : The process of transformation of spermatids into spermatozoa is called spermiation.

5. **Assertion** : Mitochondrial spiral in middle piece of sperms provides energy for their movement.

Reason : The axial filament remains surrounded by cytoplasm in the main piece.

Short Answer Type Questions

- Fill in the blanks.
 - Endocrine part of testis is represented by _____.
 - _____ are present in between the germinal epithelial cells of seminiferous tubules.
 - The collection of fluid in the tunica vaginalis of testis is called _____.
- How are vasa efferentia and vasa deferentia different from each other?
- Illustrate the hormonal control of male reproductive system with the help of diagrammatic representation.
- Write a short note on seminal vesicles.

ANSWER KEY

New MCQs

- (c)
- (a)
- (a)
- (d)
- (d)
- (d)
- (b)
- (d)
- (c)
- (c)
- (b)
- (b)
- (a)
- (b)
- (a)

Exam Section

- (d)
- (d)
- (d)
- (a)
- (c)
- (b)
- (b)
- (d)
- (b)
- (d)
- (c)
- (a)
- (a)
- (c)
- (a)

Assertion & Reason

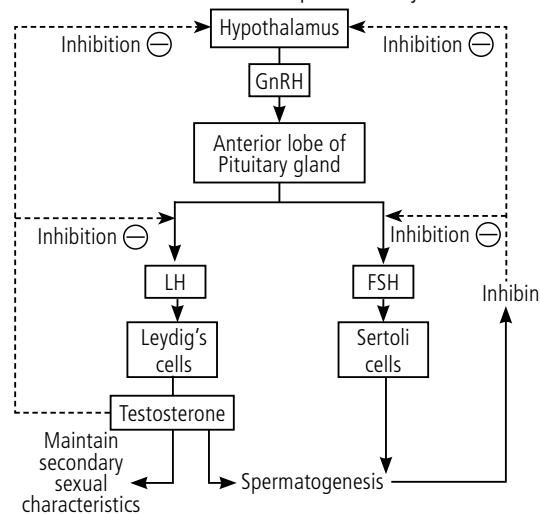
- (a)
- (c)
- (a)
- (d)
- (b)

Short Answer Type Questions

- (i) Leydig's cells, (ii) sertoli cells, (iii) inguinal hernia
- The differences between vasa efferentia and vasa deferentia are given below :

	Vasa efferentia	Vasa deferentia
(i)	They arise from the rete testis.	They arise from the cauda epididymis.
(ii)	They vary from 15 to 20 in number.	They are only 2 in number.
(iii)	They are fine.	They are thick.
(iv)	Their lining bears many ciliated cells.	Their lining has many stereocilia.
(v)	They carry spermatozoa from the rete testis to the epididymis.	These carry spermatozoa from cauda epididymis to the ejaculatory duct.

- The hormonal control of male reproductive system is :



- Seminal vesicles are a pair of elongated (5 cm), muscular and sacculated glands situated in the pelvis between the bladder and rectum. The ducts of seminal vesicles join the vasa deferentia to form ejaculatory ducts. They produce an alkaline secretion that forms about 60-70% of semen. The pH of seminal fluid is 7.4. It helps to neutralise the acidity of vaginal tract, thus prolonging the lifespan of sperm. The secretion of seminal vesicles are
 - Fructose : Provide nutrient energy for sperms.
 - Prostaglandins : Stimulate uterine contractions that help the sperm to propel towards female's oviduct.
 - Clotting proteins : Facilitates coagulation of semen after ejaculation.





NEET

Class-12

FOUNDATION

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- Recall question or single concept question – indicated by a single finger.
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- Application question or question which requires 3 or more concepts - indicated by 3 fingers.

UNIT-VII : GENETICS AND EVOLUTION

CHAPTER-5 : PRINCIPLES OF INHERITANCE AND VARIATION

Multiple Choice Questions

1. If the factors responsible for pod shape and pod colour in a pea plant studied by Mendel, to show inheritance of two genes, were located closely on same chromosome, then which of the following would not have been explained?
 - (a) Law of dominance
 - (b) Law of segregation
 - (c) Law of independent assortment
 - (d) Both (b) and (c)
2. When two homozygous black and white andalusian fowls were crossed, the F_1 individuals appeared blue and on selfing produces black, blue and white fowl in the ratio of 1 : 2 : 1. This is an example of
 - (a) dominance
 - (b) incomplete dominance
 - (c) co-dominance
 - (d) pleiotropism.
3. If a cross between two individuals produces offspring with 50% dominant character (A) and 50% recessive character (a), the genotypes of parents are
 - (a) $Aa \times Aa$
 - (b) $Aa \times aa$
 - (c) $AA \times aa$
 - (d) $AA \times Aa$.
4. The F_2 ratio in a dihybrid cross is modified from 9 : 3 : 3 : 1 to 9 : 7. This is due to the effect of
 - (a) duplicate genes
 - (b) complementary genes
 - (c) supplementary genes
 - (d) epistatic genes.
5. Due to non-disjunction of chromosomes during spermatogenesis, some sperms carry both sex chromosomes ($22A + XY$) and some sperms do not carry any sex chromosomes ($22A + 0$). If these sperms fertilise normal eggs ($22A + X$), what types of genetic disorders appear among the offspring?
 - (a) Klinefelter's syndrome and Turner's syndrome respectively
 - (b) Turner's syndrome and Klinefelter's syndrome respectively
 - (c) Down's syndrome and Turner's syndrome respectively
 - (d) Cri-du-chat syndrome and Down's syndrome respectively
6. Which of the following statements is not true for two genes that show 50% recombination frequency?
 - (a) The genes show independent assortment.
 - (b) The genes if present on same chromosome, undergo more than one crossovers in every meiosis.
 - (c) Genes may be present on different chromosomes.
 - (d) The genes are tightly linked.
7. Genic ratio between X chromosomes and autosomes in three *Drosophila* were reported as follows:

P. $\frac{X}{A} = 1$ Q. $\frac{X}{A} > 1$ R. $\frac{X}{A} = 0.5$

Based upon the genic ratio, deduce the sex of these insects.

P	Q	R
(a) Female	Metafemale	Male
(b) Male	Female	Metafemale
(c) Female	Male	Intersex
(d) Metamale	Female	Male

8. If the recombination frequencies of fruitfly between genes b (black body) and vg (vestigial wings) is 18%, (b) black body and cn (cinnabar eye) is 9% and cn (cinnabar eye) and vg (vestigial wings) is 9.5%. Identify the correct sequence of genes in fruitfly.

- (a) cn, b and vg (b) b, cn and vg
(c) vg, b and cn (d) cn, vg and b

9. The holandric type of inheritance refers to transfer of traits from

- (a) father to son
(b) father to grandson through his daughter
(c) mother to daughter
(d) father to granddaughter through his son.

10. A man having a genotype AABbCcDD can produce P number of genetically different sperms and a woman with genotype UuVvWwXx generates Q number of genetically different eggs. The values of P and Q are equivalent to

- (a) $P = 4, Q = 8$ (b) $P = 4, Q = 4$
(c) $P = 8, Q = 4$ (d) $P = 8, Q = 8$.

Match The Columns

11. Match Column I with Column II.

Column I	Column II
A. Incomplete dominance	(i) 9 : 3 : 4
B. Dominant epistasis	(ii) 9 : 7
C. Supplementary genes	(iii) 1 : 2 : 1
D. Complementary genes	(iv) 1 : 1
E. Test cross	(v) 12 : 3 : 1

12. Match Column I with Column II (There can be more than one match for items in Column I).

Column I	Column II
A. Quantitative inheritance	(i) Trisomic
B. Pleiotropy	(ii) Monosomic
C. Hyperploidy	(iii) Phenylketonuria
D. Hypoploidy	(iv) Human skin colour
E. Male heterogamety	(v) <i>Drosophila</i>
F. Female heterogamety	(vi) Pigeon
	(vii) Nullisomic
	(viii) Tetrasomic
	(ix) Sickle cell anaemia
	(x) Kernel colour in wheat
	(xi) Moths
	(xii) Cockroach

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

The chromosomal theory of inheritance was proposed by (i) and experimentally proved by (ii). The theory states that (iii) constitute bridge between the present and next generation. Hereditary traits are carried by (iv), present in nucleus. Both (iv) and (v) occur in pairs in all somatic cells. The latter are located at specific loci on the chromosomes, which segregate and assort independently during (vi) and later fusion of gametes restores (vii) in the offspring. Both the chromosomes and alleles follow law of (viii) while only those gene pairs present on different chromosomes show (ix).

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
(b) if both A and R are true but R is not the correct explanation of A
(c) if A is true but R is false
(d) if both A and R are false.

14. **Assertion :** In incomplete linkage, more parental types of offspring are produced as compared to recombinant ones.

Reason : Incomplete linkage occurs when genes are closely related to each other and do not separate during crossing over.

15. **Assertion :** Mendel's experiments on pea plant easily led him to conclude the laws of independent assortment.

Reason : Mendel luckily studied those traits whose genes were present on different chromosomes.

16. **Assertion :** Test cross is used to determine the genotype of a plant.

Reason : In test cross, the plant with unknown genotype is crossed with its recessive parent.

17. **Assertion :** Sickle cell anaemia is a sex-linked recessive disorder.

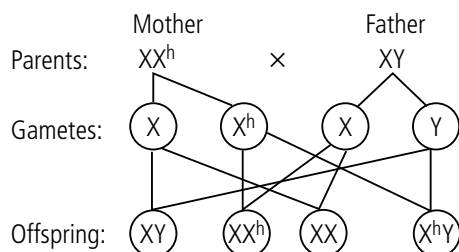
Reason : Sickle cell anaemia occurs due to the formation of abnormal haemoglobin caused by substitution of valine by glutamic acid.

18. **Assertion :** Pedigree analysis is study of pedigree for transmission of a particular trait.

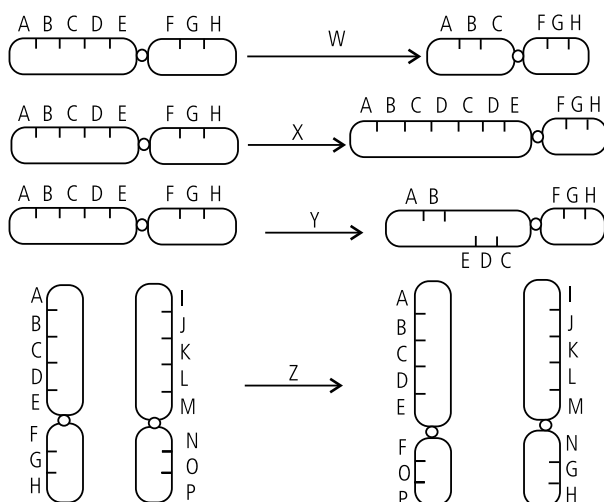
Reason : Pedigree analysis is useful for the genetic counsellors to advice couples about the possibility of having children with genetic defects.

Figure Based Questions

19. Consider the given cross and answer the following questions.



- (a) Identify the type of disease depicted by the given cross. Also name the type of inheritance shown.
 (b) In the given cross, what would be the probability of having a carrier and diseased offspring?
 (c) Name any other disease, which shows same type of inheritance pattern.
20. Refer to the given figure and answer the following questions.



- (a) Identify the types of chromosomal aberration labelled as W, X, Y and Z in the given figure.
 (b) Briefly describe aberration labelled as W and Y in the given figure.
 (c) Which of the labelled chromosomal aberration(s) represent interchromosomal aberration?

CHAPTER-6 : MOLECULAR BASIS OF INHERITANCE

Multiple Choice Questions

1. Which of the following observations of Hershey and Chase experiment proved that DNA is genetic material?
- (a) The bacteriophage labelled with radioactive sulphur made the bacterial DNA radioactive.

- (b) The bacteriophage labelled with radioactive phosphorus did not make bacteria radioactive.
 (c) Bacteriophage labelled with radioactive sulphur made only the bacterial proteins radioactive.
 (d) Bacteriophage labelled with radioactive phosphorus made the bacterial DNA radioactive.

2. Select the mismatched pair with reference to eukaryotic transcription.

- (a) RNA Pol I – Synthesises snRNA
 (b) RNA Pol II – Synthesises mRNA
 (c) RNA Pol III – Synthesises tRNA
 (d) RNA Pol III – Synthesises 5S rRNA

3. Which of the following can be used to determine original source of DNA?

- (a) $A/T = 1$ and $G/C = 1$
 (b) A - T base pairs rarely equals C - G base pairs
 (c) $\left(\frac{A+T}{G+C}\right)$ ratio is constant for a species
 (d) All of these

4. Identify the correct sequence of DNA packaging in terms of ascending order of size.

- (a) DNA → Nucleosome → Chromatin fibre → Solenoid → Chromatid → Chromosome
 (b) DNA → Nucleosome → Chromatid → Solenoid → Chromatin fibre → Chromosome
 (c) DNA → Nucleosome → Solenoid → Chromatin fibre → Chromatid → Chromosome
 (d) DNA → Nucleosome → Solenoid → Chromatid → Chromosome → Chromatin fibre

5. Which of the following events takes place during post-transcriptional modification in eukaryotes?

- (a) 7-methyl guanosine cap is added at 3' end of RNA transcript.
 (b) Addition of poly A segment at 5' end of transcript.
 (c) Exons are removed from primary transcript.
 (d) Cleavage of primary transcript by ribonuclease-P.

6. Which DNA molecule among the following will melt at lowest temperature?

- (a) 5' - A-A-T-G-C-T-G-C-3'
 3' - T-T-A-C-G-A-C-G-5'
 (b) 5' - A-A-T-A-A-A-G-C-T-3'
 3' - T-T-A-T-T-T-C-G-A-5'
 (c) 5' - G-C-A-T-A-G-C-T-3'
 3' - C-G-T-A-T-C-G-A-5'
 (d) 5' - A-T-G-C-T-G-A-T-3'
 3' - T-A-C-G-A-C-T-A-5'

7. Select the correct statement regarding repression of genes.
- It refers to switching on of operon that usually remains turned off.
 - It initiates transcription and translation of structural genes.
 - It involves the blocking of operator gene of operon.
 - None of these.

8. Arrange the various steps of DNA fingerprinting technique in the correct order.
- Separation of DNA fragments by electrophoresis
 - Digestion of DNA by restriction endonucleases
 - Hybridisation using labelled VNTR probe
 - Isolation of DNA
 - Detection of hybridised DNA fragments by autoradiography
 - Transferring the separated DNA fragments to nitrocellulose membrane
- (iv) → (ii) → (i) → (vi) → (iii) → (v)
 - (iv) → (i) → (ii) → (iii) → (vi) → (v)
 - (ii) → (i) → (iv) → (vi) → (iii) → (v)
 - (iii) → (v) → (iv) → (ii) → (i) → (vi)

9. The bacteria growing in normal environment was selected for studying its growth rate. The bacteria was moved from an environment with a light nitrogen isotope (^{14}N) to an environment with heavy nitrogen isotope (^{15}N) and its growth was studied for a period of exactly one duplication. After this, the sample is again transferred to the environment with light nitrogen for a period of two duplications.

What is the composition of hybrid DNA after the experiment?

- 75%
- 50%
- 0%
- 25%

10. Which of the following mRNA will get translated completely?

- AUGUUUCCUCAUUAGGGUGUU
- GUGUUUCCUCAUGGUUGAGUU
- AUGUUUCCUCAUGGUGUUUCC
- AUGUUUCCUUGAAUGGUUUAA

Match The Columns

11. Match Column I with Column II.

- | Column I | Column II |
|------------------------------------|---------------------------------------|
| A. Helicase | (i) Stabilises ssDNA |
| B. Single stranded binding protein | (ii) Releases tension in uncoiled DNA |
| C. Topoisomerase | (iii) Synthesises primers |
| D. Primase | (iv) Unwinds DNA strands |

12. Match Column I with Column II. (There can be more than one match for items in Column I).

Column I

- | | |
|------------------------|-----------------------|
| A. Initiation codon | (i) AUG |
| B. Phenylalanine | (ii) UAA |
| C. Template strand | (iii) UUU |
| D. Termination codon | (iv) Minus strand |
| E. Non-template strand | (v) Plus strand |
| F. Arginine | (vi) GUG |
| | (vii) UGA |
| | (viii) AGG |
| | (ix) Antisense strand |
| | (x) CGU |
| | (xi) UUC |
| | (xii) Sense strand |

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

The double helical structure of DNA was proposed by (i) and (ii) on the basis of data obtained from (iii). According to their model, the two chains of double stranded helix run (iv) to each other. The backbone of each chain is made of (v). The (vi) of two chains form complementary pairs. The DNA usually shows (vii) coiling producing major and minor grooves alternately. The pitch of helix in B-DNA is 3.4 nm with (viii) base pairs in each turn. However, another right handed, (ix) has only a single turn of helix with (x) base pairs that lie 20° away from the axis.

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- if both A and R are true and R is the correct explanation of A
- if both A and R are true but R is not the correct explanation of A
- if A is true but R is false
- if both A and R are false.

14. **Assertion :** DNA is preferred over RNA for storage of genetic information.

Reason : DNA undergoes rapid mutation and evolves very fast.

15. **Assertion :** One gene one enzyme hypothesis was changed into one gene one polypeptide hypothesis.

Reason : One gene one enzyme hypothesis states that structural gene specifies synthesis of many polypeptides.

16. **Assertion :** DNA polymorphism is the basis for genetic mapping of human genome as well as DNA fingerprinting.

Reason : Polymorphism in DNA arises due to mutations.

17. **Assertion :** The opposite strands of DNA chains are not identical but complementary to each other.

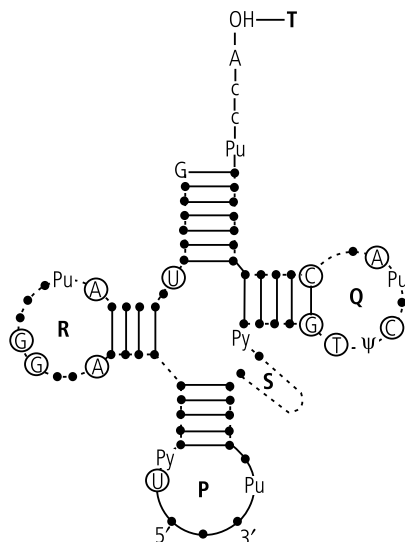
Reason : Specific base pairing occurs between a purine lying opposite to a pyrimidine.

18. **Assertion :** A peptide bond ($-\text{CO}-\text{NH}-$) is established between the amino group ($-\text{NH}_2$) of amino acid at P site, and carboxyl group ($-\text{COOH}$) of amino acid at A-site.

Reason : Peptide bond formation during translation is catalysed by a protein enzyme peptidyl transferase.

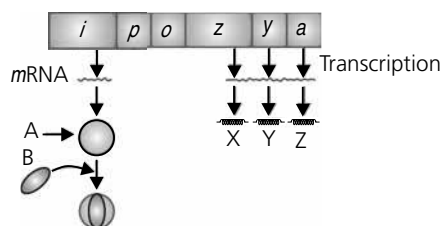
Figure Based Questions

19. Refer to the given figure and answer the following questions.



- Identify the parts P, Q, R, S and T in the given figure.
- State the function of Q and R in the molecule.
- What is the above molecule called? Name the site for recognition and attachment of mRNA codon.

20. Read the given figure and answer the following questions.



- Identify A, B, X, Y and Z in the given figure.
- Briefly describe the function of A.
- Which labelled part is involved in hydrolysing the lactose?

CHAPTER-7 : EVOLUTION

Multiple Choice Questions

1. The Hardy-Weinberg principle cannot operate if
- gene flow does not occurs between population
 - frequent mutations occur in the population

- the population has no chance of interaction with other populations
- free interbreeding occurs among all members of the population.

2. The extinct human ancestor, whose fossil was discovered by Edward Lewis from Pliocene rocks of Shivalik Hills of India was

- Ramapithecus*
- Australopithecus*
- Dryopithecus*
- Homo erectus*.

3. Which of the following options gives one correct example each of convergent evolution and divergent evolution?

Convergent evolution

- Thorns of *Bougainvillea* and tendrils of *Cucurbita*
- Eyes of octopus and mammals
- Bones of forelimbs of vertebrates
- Thorns of *Bougainvillea* and tendrils of *Cucurbita*

Divergent evolution

- Wings of butterfly and birds
- Bones of forelimbs of vertebrates
- Wings of butterfly and birds
- Eyes of octopus and mammals

4. An isolated population of humans with approximately equal numbers of blue-eyed and brown-eyed individuals was decimated by an earthquake. Only a few brown-eyed

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people remained to form the next generation. This kind of change in the gene pool is called

- (a) Hardy-Weinberg equilibrium
- (b) blocked gene flow
- (c) bottle-neck effect
- (d) gene migration.

5. Refer to the main features of theory of natural selection.

- (i) Limited food and space
- (ii) Formation of new species
- (iii) Variations
- (iv) Natural selection
- (v) Struggle for existence
- (vi) Inheritance of useful variations over many generations
- (vii) Rapid multiplication

Select the correct sequence of speciation.

- (a) (vii) → (i) → (vi) → (iii) → (iv) → (v) → (ii)
- (b) (vii) → (i) → (v) → (iii) → (iv) → (vi) → (ii)
- (c) (vii) → (i) → (v) → (iii) → (vi) → (iv) → (ii)
- (d) (vii) → (i) → (iii) → (v) → (iv) → (vi) → (ii)

6. In a population of 1000 individuals, 360 belong to genotype AA, 480 to Aa and the remaining 160 to aa. Based on this data, the frequency of allele A in the population is

- (a) 0.4 (b) 0.5 (c) 0.6 (d) 0.7.

7. According to Oparin, coacervates are

- (a) non-living collection of organic macromolecules with double layered membrane
- (b) protein-like structures consisting of branched chains of amino acids
- (c) lipid molecules enclosed by a living protein membrane
- (d) non-living structures comprising of organic biomolecules, surrounded by a film of water.

8. Alligators distributed all over the North American continent and East Asia got separated due to certain barriers and developed some mutations, as a result of which they evolved into different species.

This is an example of

- (a) parallel evolution (b) adaptive radiation
- (c) restricted distribution
- (d) discontinuous distribution.

9. Which of the following is not an example of atavism?

- (a) Long dense hairs in humans
- (b) Conversion of some stamens and carpels to petal-like structures in *Oxalis*
- (c) Well developed canine teeth in humans
- (d) Leaves reduced to scales in *Rucus*.

10. Choose the correct series of human evolution.

- (a) *Dryopithecus* → *Homo erectus* → *Australopithecus* → Cro-Magnon man

(b) *Australopithecus* → *Homo erectus* → Neanderthal man → *Homo sapiens*

(c) *Australopithecus* → *Ramapithecus* → *Dryopithecus* → *Homo sapiens*

(d) *Homo erectus* → *Australopithecus* → Cro-Magnon man → Neanderthal man

Match The Columns

11. Match Column I with Column II.

Column I

- A. Raymond Dart
- B. Hugo de Vries
- C. Adaptive radiation
- D. Donald Johanson
- E. Industrial melanism

Column II

- (i) Peppered moth
- (ii) Tuang baby
- (iii) Lucy
- (iv) Saltation
- (v) Darwin's finches

12. Match Column I with Column II. (There can be more than one match for items in Column I)

Column I

- A. Connecting link
- B. Missing link
- C. Adaptive radiation
- D. Analogous organs

Column II

- (i) Australian Marsupials
- (ii) Prosimians
- (iii) *Ornithorhynchus*
- (iv) Flippers of Dolphin and pectoral fins of shark
- (v) *Ichthyostega*
- (vi) Simians
- (vii) *Protopterus*
- (viii) Sting of honey bee and scorpion
- (ix) Darwin's finches
- (x) *Seymouria*

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

The process by which the organisms that appear physically, physiologically and behaviourally better adapted to the environment, survive and reproduce is called (i). This process depends upon the existence of (ii) within the population. In (iii) selection, average sized individuals are favoured over small sized ones, reduces (iv) and thus evolutionary change does not occur. Graphical curve obtained from such population is (v). During progressive selection, the (vi) size of population changes. (vii) selection favours both small and large sized individuals. It produces two peaks in distribution of traits, leading to development of different (viii). (vii) selection is rare in nature but plays an important role in (ix). Evolution of DDT resistant mosquitoes is an example of (x) selection.

Assertion & Reason

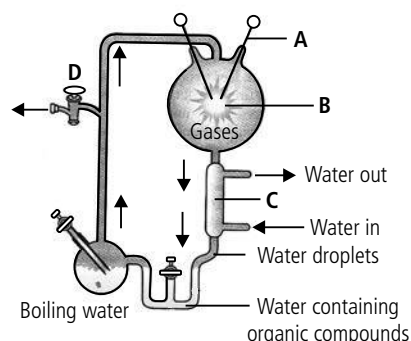
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(b) if both A and R are true but R is not the correct explanation of A
(c) if A is true but R is false
(d) if both A and R are false.

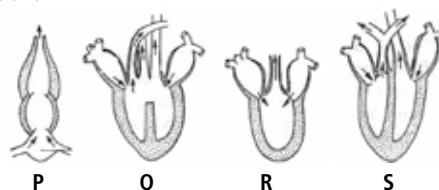
- 14. Assertion :** Genetic drift is an evolutionary force.
Reason : Genetic drift occurs in all types of population but is markedly visible in population of large size.
- 15. Assertion :** Primitive atmosphere of earth was reducing.
Reason : Hydrogen atoms present in primitive atmosphere combined with all oxygen atoms to form water, leaving no free oxygen.
- 16. Assertion :** Fossil ostracoderms probably evolved from unarmoured ancestors such as *Jamoytius*.
Reason : Before extinction, ostracoderms gave rise to first bony fishes.
- 17. Assertion :** Balanced polymorphism occurs when different forms co-exist in the same population in a stable environment.
Reason : In humans, the existence of A, B, AB and O blood groups represent balanced polymorphism.
- 18. Assertion :** Cro-Magnon man is regarded as most primitive ancestor of *Homo erectus*.
Reason : Cro-Magnon man was first tool maker and used tools of chipped stones.

Figure Based Questions

- 19.** Refer to the given figure and answer the following questions.



- (a) Identify the given figure and the labelled parts A, B, C and D.
(b) In the given experiment, which gases were used to simulate primitive atmosphere?
(c) Briefly describe the experiment given in the figure.
- 20.** Refer to the figures given below and answer the following questions.



- (a) Identify the diagrammatic structures P, Q, R and S.
(b) What do these structures signify?
(c) Give an example of organs showing similar relationship.
(d) What type of evolution do these structures represent?

SOLUTIONS

CHAPTER-5 : PRINCIPLES OF INHERITANCE AND VARIATION

1. (c) 2. (b) 3. (b) 4. (b) 5. (a)
6. (d) 7. (a) 8. (b) 9. (a) 10. (a)
11. A-(iii), B-(v), C-(i), D-(ii), E-(iv)
12. A-(iv, x), B-(iii, ix), C-(i, viii), D-(ii, vii), E-(v, xii), F-(vi, xi)
13. (i) Sutton and Boveri (ii) T.H. Morgan
(iii) gametes (iv) chromosomes
(v) genes (vi) meiosis
(vii) diploid chromosome number
(viii) segregation
(ix) law of independent assortment
14. (c) 15. (a) 16. (a) 17. (d) 18. (b)
19. (a) The above cross shows the inheritance of haemophilia, which is a sex-linked recessive disorder. It shows criss-cross type of inheritance.

- (b) In the given cross, the ratio of carrier and diseased offspring would be 1 : 1. If the carrier female (XX^h) marries a normal male (XY), four types of children are produced as given by the cross (XX, XX^h, X^hY, XY). In other words, 50% boys as well as 50% girls receive the gene for haemophilia through the X^h chromosome of their mother. However, the defect does not appear in the girls because of the presence of the allele for normal blood clotting is found on one of the X-chromosome (XX^h). Therefore, the girls remain carrier. 50% of the males who receive the defective gene for haemophilia (X^hY) suffer from the disease as the Y-chromosome does not carry any allele for it.
- (c) Colourblindness is another sex-linked recessive disorder, that shows criss-cross inheritance.
20. (a) W-Deletion; X-Duplication; Y-Inversion;
Z-Reciprocal translocation

- (b) In the given figure, W represents deletion. It is the loss of an intercalary segment of a chromosome which is produced by a double break in the chromosome followed by the union of remaining parts, e.g., ABCDEFGH/ABCFGH (segment DE is missing).

The chromosomal aberration labelled as Y represents inversion. Here part of the chromosome segment gets inverted by 180°. For example, chromosome ABCDEFGH develops inversion in the part CDE to form ABEDCFGH.

- (c) Reciprocal translocation (Z) and duplication (X) in the given figure represent interchromosomal aberrations.

CHAPTER-6 : MOLECULAR BASIS OF INHERITANCE

1. (d) 2. (a) 3. (c) 4. (c) 5. (d)
6. (b) 7. (c) 8. (a) 9. (d) 10. (c)

11. A-(iv), B-(i), C-(ii), D-(iii)

12. A-(i, vi), B-(iii, xi), C-(iv, ix), D-(ii, vii), E-(v, xii), F-(viii, x)

13. (i) Watson (ii) Crick
(iii) X-ray crystallography (iv) antiparallel
(v) sugar phosphate (vi) nitrogenous bases
(vii) right handed (viii) 10
(ix) A-DNA (x) 11

14. (c) 15. (c) 16. (b) 17. (a) 18. (d)

19. (a) P-Anticodon loop, Q-TΨC loop, R-DHU loop, S-Variable arm and T-Amino acid attaching site

- (b) In the given figure, Q is the TΨC loop that provides site for attachment to ribosome while R is DHU loop which acts as binding site for aminoacyl synthetase enzyme, during protein synthesis.

- (c) The above molecule is called adapter molecule. Anticodon loop (part P) is the site that has three bases out of seven which help in recognising and attaching to the codon of mRNA.

20. (a) A-Repressor protein, B-Inducer, X-β-galactosidase, Y-Permease and Z-Transacetylase

- (b) The given figure is of the *lac* Operon in the presence of an inducer. A represents the repressor protein that is meant for blocking the operator gene so that the structural genes are unable to form mRNAs (transcribe). It has two allosteric sites, one for attaching to operator gene and other for binding to the inducer. After coming in contact with inducer the repressor undergoes conformational change and is unable to combine with operator, which allows the transcription of z, y and a gene.

- (c) β-galactosidase (X) is involved in hydrolysing lactose by breaking lactose into glucose and galactose.

CHAPTER-7 : EVOLUTION

1. (b) 2. (a) 3. (b) 4. (c) 5. (b)
6. (c) 7. (d) 8. (d) 9. (d) 10. (b)

11. A-(ii), B-(iv), C-(v), D-(iii), E-(i)

12. A-(iii, vii), B-(v, x), C-(i, ix), D-(iv, viii), E-(ii, vi)

13. (i) natural selection (ii) phenotypic variation
(iii) stabilising (iv) variation
(v) bell shaped (vi) mean
(vii) Disruptive (viii) populations
(ix) evolution (x) directional

14. (c) 15. (a) 16. (b) 17. (b) 18. (d)

19. (a) The given figure is the diagrammatic representation of Miller's experiment.

A-Electrode; B-Spark discharge; C-Condenser;
D-Vacuum pump

- (b) In the given experiment methane (CH₄), ammonia (NH₃), water vapour and hydrogen (H₂) were used to simulate primitive atmosphere.

- (c) Stanley Miller in 1953 took an air tight apparatus and circulated four gases - CH₄, NH₃, H₂ and water vapour through it and passed electrical discharges from electrodes at 800°C. Then he passed the mixture through a condenser. He performed this experiment continuously in this way for few days and analysed the composition of the liquid inside the apparatus. He found a large number of simple organic compounds including some amino acids such as alanine, glycine and aspartic acid. Miller, thus, proved that organic compounds would have formed in the primitive reducing environment of Earth, which were further the essential building blocks of living organisms.

20. (a) P-Heart of fish; Q-Heart of reptiles; R-Heart of amphibians; S-Heart of mammal/bird.

- (b) All these hearts show the same fundamental structure, hence are homologous organs. Since, these are adapted to function differently in different environment, they represent divergent evolution.

- (c) Thorns of *Bougainvillea* and tendrils of *Cucurbita* also show divergent evolution. They are similar in structure as they arise from nodes, in axillary position but have different functions, hence are homologous organs.

- (d) These structures represent divergent evolution.



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HIGH YIELD FACTS



Class XII

EVOLUTION-II

- The various evidences of evolution ascertain that simple living organisms gradually modified into complex forms. This idea of organic evolution dates back to 322 B.C. when Aristotle believed in a ladder-like gradation in nature and suggested that there had been a gradual transition from the simple and imperfect to the complex and perfect. Similarly, Buffon (1707-1788 A.D) the great French naturalist was the first to propose the direct modifying influence of the environment. He is therefore, also considered as the "Father of Evolutionary Concept".
- However, the first person to put forth an elaborate theory of organic evolution and the origin of species by adaptations to environments was also a French naturalist, Jean-Baptiste de Lamarck. Many more theories have been proposed later to explain the concepts of organic evolution.
- Some of the important theories to be discussed here are:

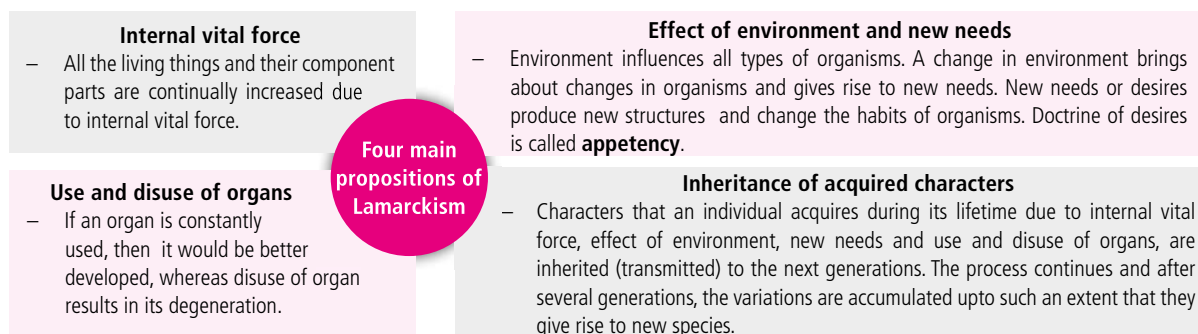
Theories of Evolution

- Lamarck's theory
- Darwin's theory
- Hugo de Vries' theory
- Synthetic theory of evolution

LAMARCK'S THEORY

- Lamarck published his theory of evolution in 'Philosophie Zoologique' in 1809. It is popularly known as 'the inheritance of acquired characters in organisms'. It can be defined as "the changes in structure or function of any organ acquired during the life time of an individual in response to changes in the surrounding environment are inherited by its offspring and keep on adding up over a period of time".
- Thus, Lamarck stressed on adaptations as means of evolutionary modification.

Analysis of various PMTs from 2013-2017						
	2013	2014	2015	2016	2017	
AIPMT/NEET	2	2	1	4	-	
AIIMS	1	-	2	-	2	
AMU	4	-	1	-	-	
Kerala	-	1	2	-	-	
K-CET	1	2	2	-	-	
J & K	-	-	1	-	-	



Evidences in Favour of Lamarckism

- Lamarck cited examples from phylogenetic studies of giraffe and other animals to support his theory.
- **Giraffe** : It explains that the development of long necked and forelimbed giraffe from short necked and forelimbed-deer like ancestors took place by gradual elongation of neck and forelimbs in response to deficiency of food on the barren ground in dry deserts of Africa. This is an example of effect of extra use and elongation of certain organs.
- **Snake** : Limbless snakes with long slender body have developed from the limbed ancestors due to continued disuse of limbs and stretching of body to suit the creeping mode of locomotion. It indicates the disuse and degeneration of certain organs.
- **Aquatic birds** : They developed from their terrestrial ancestors by reduction of wings due to continued disuse and development of webs between their toes for wading purposes. This may have taken place due to deficiency of food on land and severe competition.
- **Horse** : The ancestors of modern horse used to live in areas with soft ground and had short legs with more number of functional digits. As they gradually moved to areas with dry ground, they developed longer legs with less number of functional digits so as to run fast over solid and hard ground.

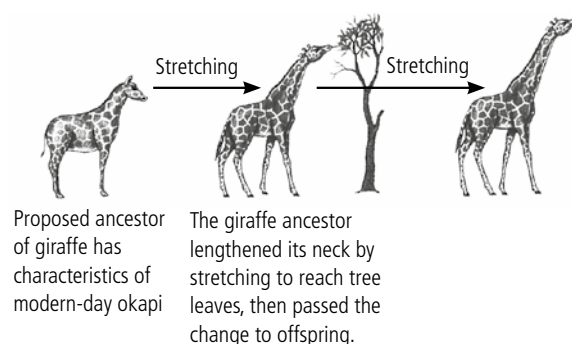


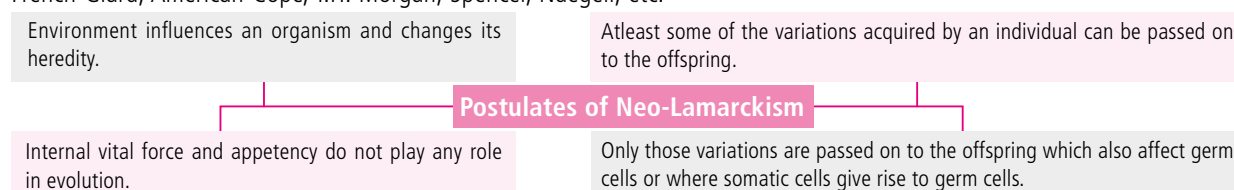
Fig.: Stages in the evolution of present day giraffe according to Lamarck

Criticism of Lamarckism

- **Lamarck's theory of inheritance of acquired characters was disapproved by a German biologist August Weismann.** He cited many examples and put forth the **theory of continuity of germplasm**.
- According to this theory, the characters influencing the germ cells are only inherited. There is a continuity of germplasm (protoplasm of germ cells) but the somatoplasm (protoplasm of somatic cells) is not transmitted to the next generation. Weismann cut off the tails of rats for as many as 22 generations and allowed them to breed, but tailless rats were never born.
- Boring of pinna (external ear) and nose of Indian women is never inherited to the next generations.
- The wrestler's powerful muscles are not transmitted to the offspring.
- Chinese women used to wear iron shoes in order to have small feet, but their children at the time of birth always had normal feet.
- In Jews and Muslims, circumcision of penis is followed but it is not inherited to the next generation.

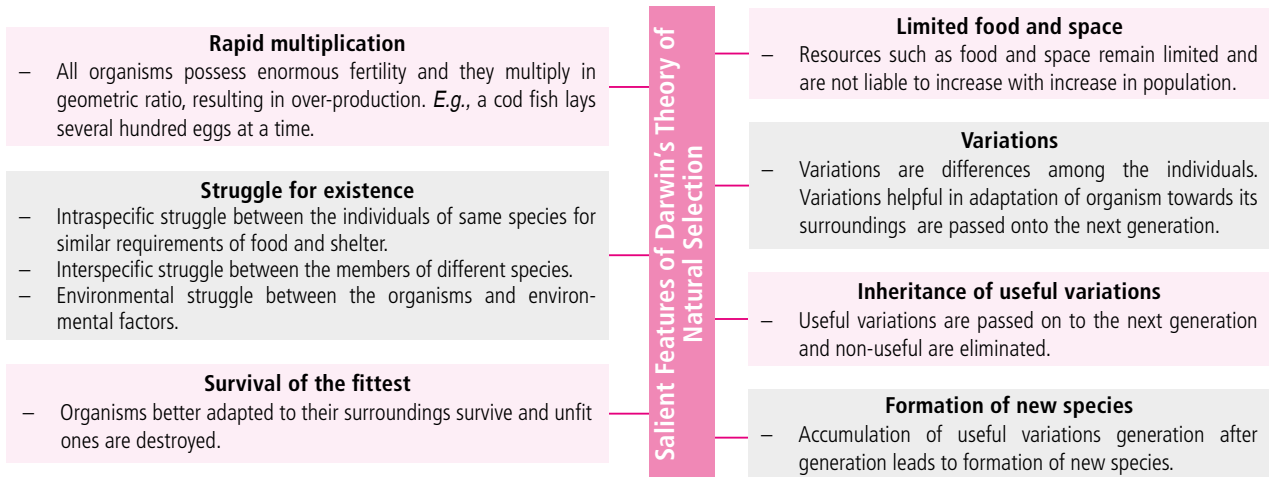
Neo-Lamarckism

- Recent studies have confirmed that environment does affect the form, structure, colour, size, etc., and such changes are inheritable. The term Neo-Lamarckism was coined by Alphaeus S. Packard and is contributed by many scientists such as French Giard, American Cope, T.H. Morgan, Spencer, Naegeli, etc.



DARWIN'S THEORY OF NATURAL SELECTION

- **Charles Darwin**, an English naturalist and one of the most dominant biologists of 19th century made an extensive study of nature for over 20 years while on a voyage of world exploration on a famous ship H.M.S. Beagle.
- During this journey, he explored the fauna and flora of a number of continents and islands such as Galapagos islands. There he observed great variations among the organisms living there and called it "a living laboratory of evolution."
- Later, he proposed the theory of natural selection in his book "Origin of Species by Means of Natural Selection".



Evidences in Favour of Darwinism

- Higher rate of reproduction in all organisms.
- Limitation of food, space and other resources.
- Struggle for existence is seen in all organisms.
- Abundance of variations among individuals of a population.
- Mimicry and protective colouration in certain animals.
- Correlation between position of nectaries in flowers and length of proboscis in pollinating insects.

Criticism Against Darwinism

- Darwin did not differentiate between somatic and germinal variations and considered all variations as heritable.
- Occurrence of organisms that remained unchanged for several million years.
- Occurrence of discontinuous variations.
- Arrival of the fittest cannot be explained.
- The effect of use and disuse and the presence of vestigial organs cannot be explained.

Branching descent and natural selection are two important postulates of Darwinism. Branching descent can be best explained by convergent evolution of Australian Marsupials and placental mammals. Natural selection of different traits can be of stabilising, directional and disruptive type.

Principle of Natural Selection

- The principle of natural selection arises from five important observations and three inferences. It was proposed by **Ernst Mayer** in 1982. It demonstrates that natural selection is the differential success in reproduction and it operates through interactions between the environment and inherent variability in the population.

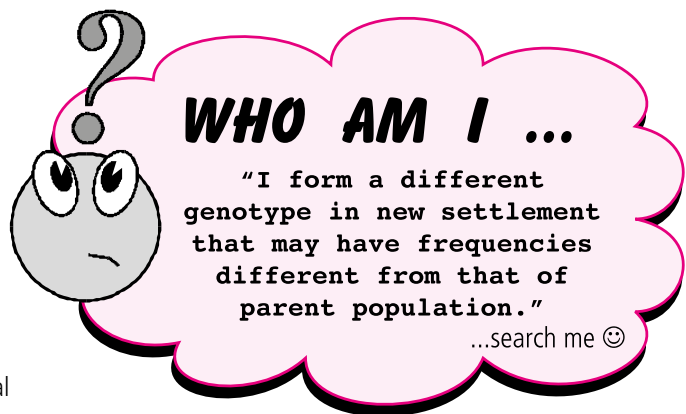


Table : Observations and inferences of principle of natural selection

Observations		Inferences	
(i)	All species have such great potential of fertility that their population size would increase exponentially if all individuals that were born reproduced successfully.		—
(ii)	Most populations are normally stable in size, except for seasonal fluctuations.		—
(iii)	Natural resources are limited.	(a)	Production of more individuals than the environment can support leads to a struggle for existence among individuals of a population, with only a fraction of offspring surviving each generation.
(iv)	Individuals of a population vary extensively in their characteristics, no two individuals are exactly alike.		—
(v)	Much of this variation is heritable.	(b)	Survival in the struggle for existence is not random, but depends in part on the hereditary constitution of the surviving individuals. Those individuals whose inherited characteristics fit them best in their environment are likely to leave more offspring than less fit individuals.
		(c)	The unequal ability of individuals to survive and reproduce will lead to a gradual change in a population with favourable characteristics accumulating over the generations.

HUGO DE VRIES' MUTATION THEORY

- Hugo de Vries, a Dutch botanist proposed the mutation theory of evolution, based on the observations of the experiments conducted on *Oenothera lamarckiana* (evening primrose).

Salient Features of Mutation Theory

- Mutations or (discontinuous variations) are the raw material of evolution.
- Mutations appear all of a sudden and become operational immediately.
- Unlike Darwin's continuous variations or fluctuations, mutations do not revolve around the mean or normal character of the species.
- The same type of mutations can appear in a number of individuals of a species.
- All mutations are inheritable.
- Mutations appear in all conceivable directions.
- Useful mutations are selected by nature whereas lethal mutations are eliminated. However, useless and less harmful ones can persist in the progeny.

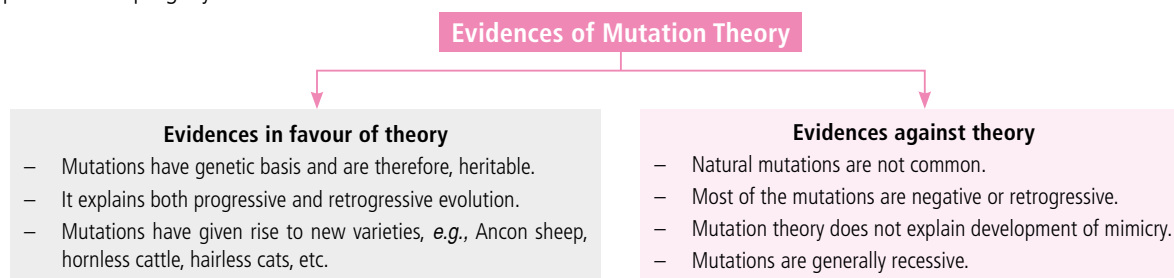


Table : Differences between Hugo de Vries' mutation and Darwinian variation

	Hugo de Vries' mutation	Darwinian variation
(i)	Mutations appear all of a sudden.	Darwinian variations are gradual.
(ii)	Mutations are the raw material of evolution.	Continuous variations are the basis of evolution.
(iii)	Mutations are due to change in genetic makeup.	Genes were not known to Darwin.

MODERN CONCEPT OF EVOLUTION

- The modern concept of evolution is a modified form of Darwin's theory of natural selection and Hugo de Vries' theories. It is also called **synthetic theory of evolution**.
- It is the most accepted theory of evolution in modern times. Many scientists like T. Dobzhansky, R.A. Fisher, J.B.S. Haldane, Sewall Wright, Ernst Mayr have contributed to the modern theory of evolution but the final shape of 'Modern Synthetic theory of Evolution' was given by Stebbins.
- The modern synthetic theory of evolution includes the following factors:

Genetic Variations in Population

- Changes in genes occur in following ways:
 - Changes in chromosome number (increases in number of chromosome set) and structure (change in the morphology of chromosome), due to duplication, inversion, deletion or translocation.
 - Change in structure and expression of gene by mutations and mutated genes add new alleles to the gene pool.
 - Gene recombination which occur due to independent assortment of chromosomes, crossing over, random fusion of gametes, etc.
 - Gene migration (gene flow) is the movement of individuals from one place to another, which add new alleles to the local gene pool.
 - Genetic Drift or Sewall Wright Effect is the drastic change in allele frequency when population size becomes very small and it alters gene frequency of remaining population. Examples of genetic drift are:
 - Founder effect** : Small group of persons leave the population and find new settlement. Their genotypic frequency becomes different from parent population.
 - Bottleneck effect** : Cyclic phenomenon of decrease and increase of a size of population.
- Non-random mating** : Repeating mating between individuals for certain selected traits changes the gene frequency. For example, the selection of more brightly coloured male by a female bird will increase the gene frequency of bright colour in the next generation.
- Hybridisation** : It is the crossing of genetically different organisms, usually in one or more traits. It helps in intermingling of genes of different groups of same variety, species, etc.
- All of these factors result in genetic variations in a population by sexual reproduction.

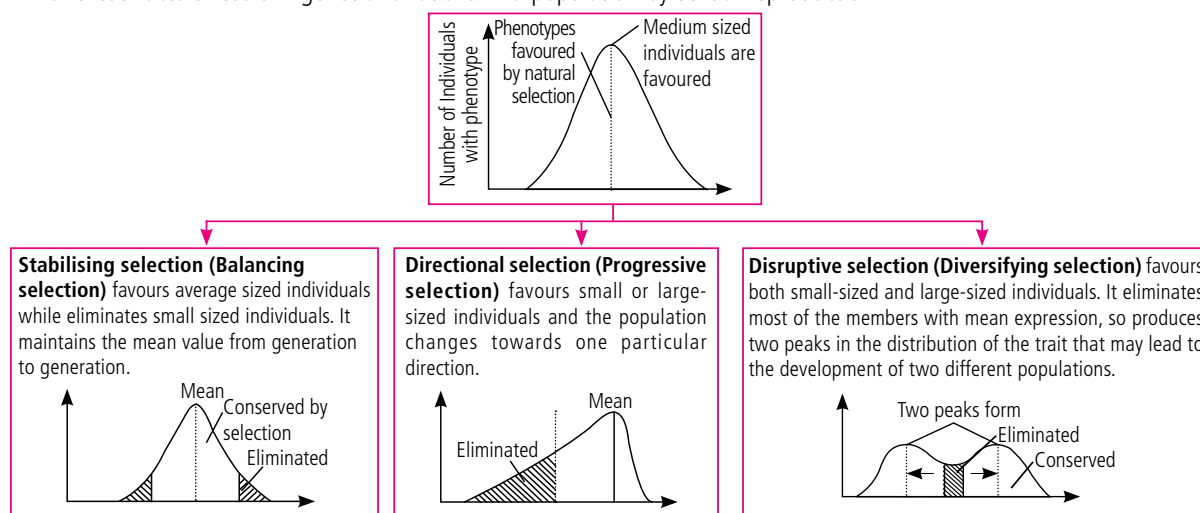


Fig.: Different Types of Natural Selection

Sickle cell anaemia

The sickle cell gene produces a variant form of the protein haemoglobin, which differs from the normal haemoglobin by a single amino acid. Sickle cell anaemia is caused by the substitution of glutamic acid by valine at sixth position of beta chain of normal haemoglobin. In people, homozygous for this abnormal haemoglobin, the red blood cells (RBCs) become sickle-shaped. The people affected by this disease usually die before reproductive age, due to a severe haemolytic anaemia. In spite of its disadvantageous nature, the gene has a high frequency in some parts of Africa, where malaria is also in high frequency. The heterozygotes for the sickle cell trait are exceptionally resistant to malaria. Thus, in some parts of Africa, people homozygous for the normal gene tend to die of malaria and those homozygous for sickle cell anaemia tend to die of severe anaemia; while the heterozygous individuals survive and have the selective advantage over either of homozygotes.

Examples of Natural Selection

Industrial melanism

In Great Britain, *Biston betularia* (peppered moth) existed in two forms, light coloured (white) and melanic (black). Before industrialisation, barks of trees were covered by white lichens, so white moths escaped unnoticed from predatory birds. After industrialisation, barks got covered by smoke, so population of white moths were selectively picked up by birds and black moths increased as they escaped unnoticed.

Resistance of insects to pesticides

When DDT was introduced as an insecticide, it was effective against pests. But within two to three years of the introduction of this insecticide, new DDT resistant mosquitoes appeared in the population. These mutant strains, which are resistant to DDT, soon became well established in the population and to a great extent, replaced the original DDT-sensitive mosquitoes.

SPECIATION

- Formation of one or more new species from an existing species is called **speciation**.

Allopatric speciation

In this type of speciation, a part of the population becomes geographically isolated from the main population and becomes entirely separated and finally constitutes a new species. Thus, geographic isolation brings about allopatric speciation, for example: formation of Darwin's finches that formed separate species in the Galapagos Islands.

Sympatric speciation

A small segment of the original population becomes isolated reproductively. As the isolating mechanism comes into force, a new subspecies emerges and new species is formed. Thus, sympatric speciation is the formation of species within a single population without geographical isolation. *E.g.*: Pig frog and Gopher frog occur in different habitats.

Types of Speciation

Parapatric speciation

It takes place when a population of a species enters a new niche or habitat. It occurs only at the edge of the parent species range. Although there is no physical barrier between these populations, yet the occupancy of a new niche results as a barrier to gene flow between the population of new niche. Two species are produced due to reproductive isolation from single one. *E.g.*: speciation in flightless grasshoppers, snails and annual plants.

Quantum speciation

The budding off a new and very different daughter species from a semi-isolated peripheral population of the ancestral species is quantum speciation. This is based on the observation of H.L. Carson on *Drosophila* inhabiting Hawaii islands. It is a sudden and rapid speciation where genetic drift or chance plays a major role in quantum speciation.

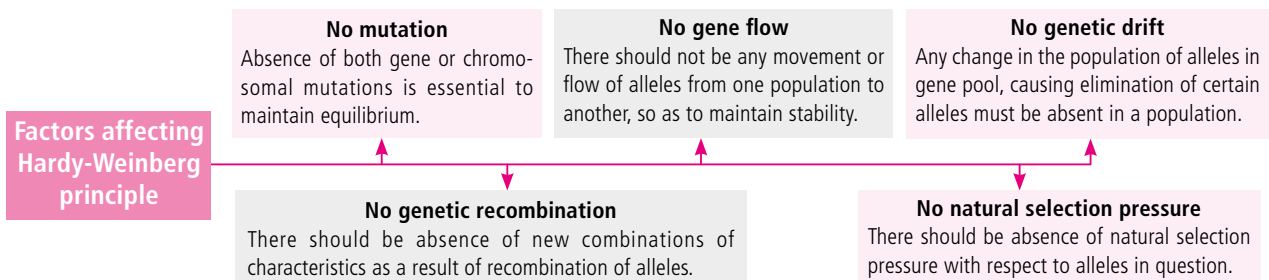
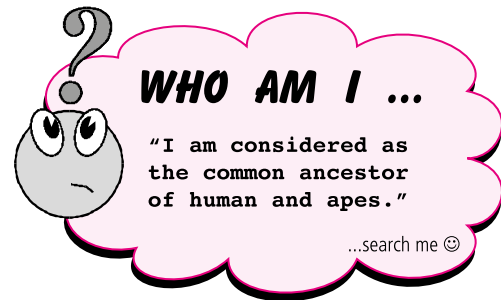
Table : Differences between allopatric and sympatric speciation

Allopatric speciation	Sympatric speciation
<ul style="list-style-type: none"> A new species arises because a physical barrier separates it from other members of an existing species. 	<ul style="list-style-type: none"> A new species arises from an existing species that is living in the same area.
<ul style="list-style-type: none"> Physical barriers may include mountain ranges, valleys of water bodies or human-made features such as roads, canals of built-up areas. 	<ul style="list-style-type: none"> Temporal and behavioural isolations produce significant changes in the genetic make-up within a species so that a new species is formed.

HARDY-WEINBERG PRINCIPLE

- Hardy-Weinberg's principle describes a theoretical situation in which a population is undergoing no evolutionary change. It explains the stability of population and species over a number of generations.
- "The relative frequencies of various kinds of genes in a large and randomly mating sexual panmictic population tend to remain constant from generation to generation in the absence of mutation, selection and gene flow." This is called Hardy-Weinberg principle or Hardy-Weinberg equilibrium. This principle is an expression of the notion of a population in 'genetic equilibrium' and is the basic principle of **population genetics**.
- In a population at equilibrium, for a locus with two alleles, D and d having frequencies of p and q, respectively, the genotype frequencies are: $DD = p^2$, $Dd = 2pq$ and $dd = q^2$.

- The two formulae are $p^2 + 2pq + q^2 = 1$, $p + q = 1$
 where, p = Frequency of the dominant allele in the population
 q = Frequency of the recessive allele in the population
 p^2 = Percentage of homozygous dominant individuals
 q^2 = Percentage of homozygous recessive individuals
 $2pq$ = Percentage of heterozygous individuals
 1 = Sum total of all the allelic frequencies



- Constant gene frequencies over several generations indicate that evolution is not taking place whereas change in gene frequencies indicate progress/onset of evolution. Thus, evolution occurs when genetic equilibrium is upset.

BRIEF ACCOUNT OF EVOLUTION

Evolution of Plants

- It is considered that first cellular forms of life originated about 2000 million years ago. Some of these cells developed pigments to capture solar energy and release oxygen by employing water as hydrogen donor during photosynthesis. The prokaryotes originated in archaeozoic era. Gradually prokaryotes became eukaryotes. These eukaryotic cells diversified to form green algae and early invertebrates. Each of which evolved and gave rise to plants and animals respectively.

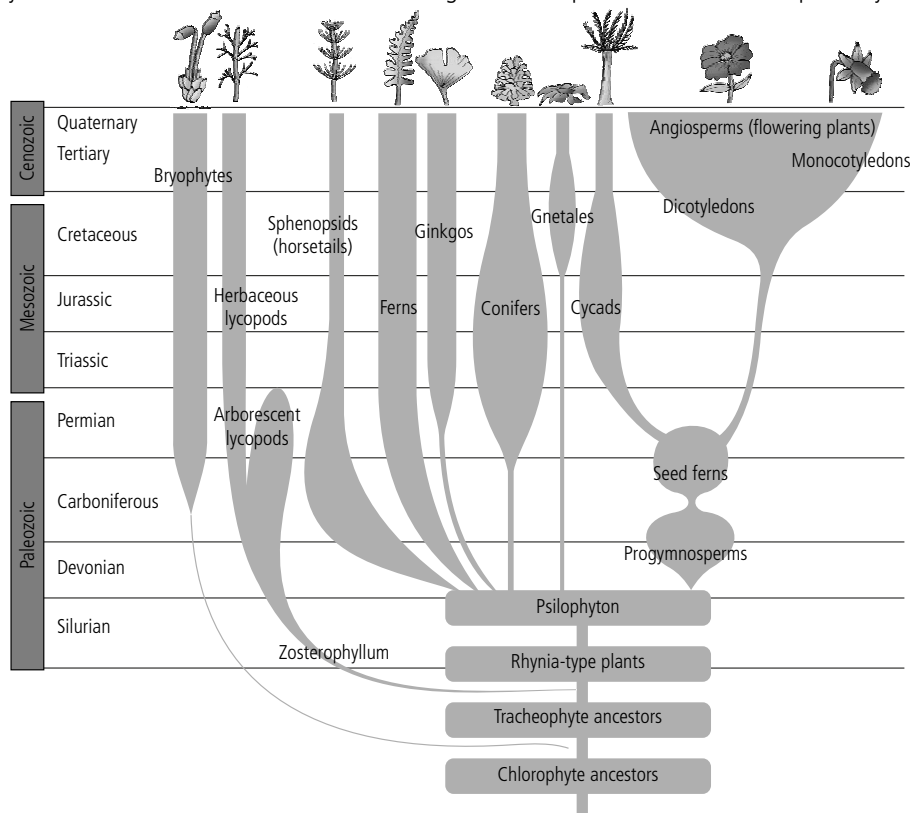


Fig.: A sketch of the evolution of plant forms through geological periods

Evolution of Vertebrates

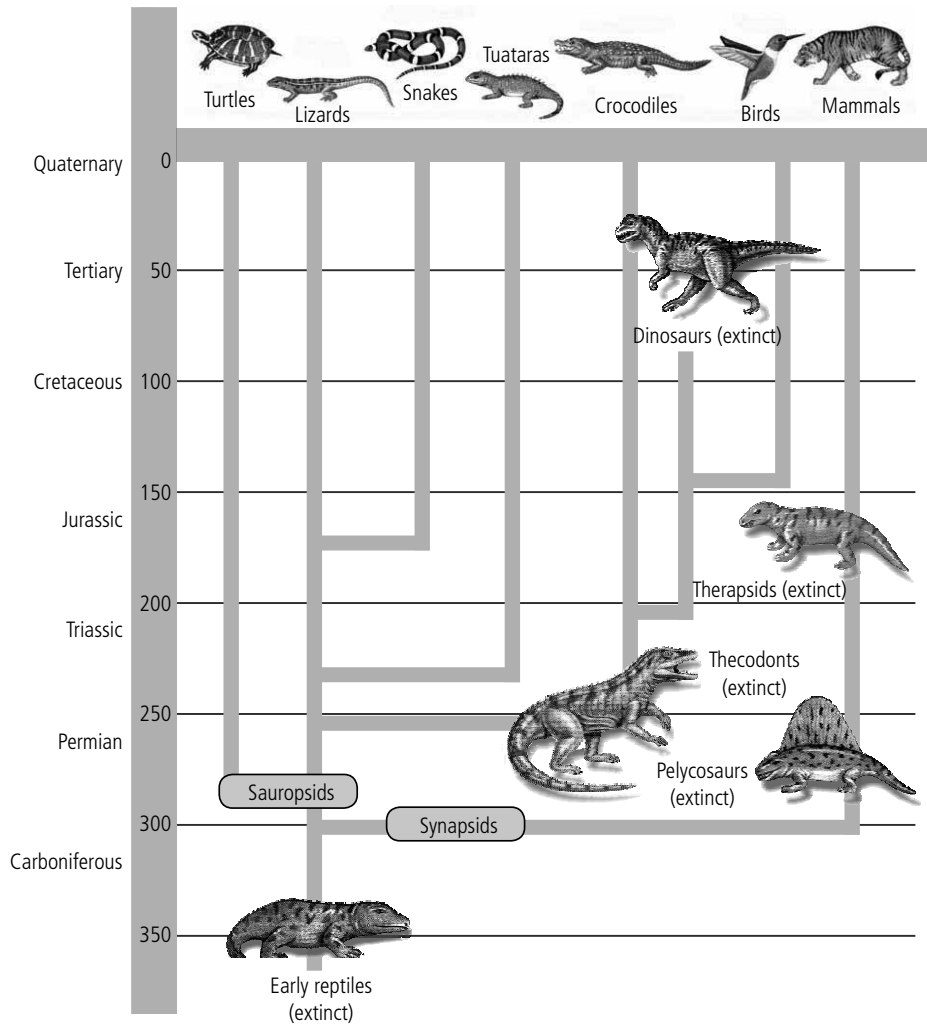


Fig.: Representative evolutionary history of vertebrates through geological periods

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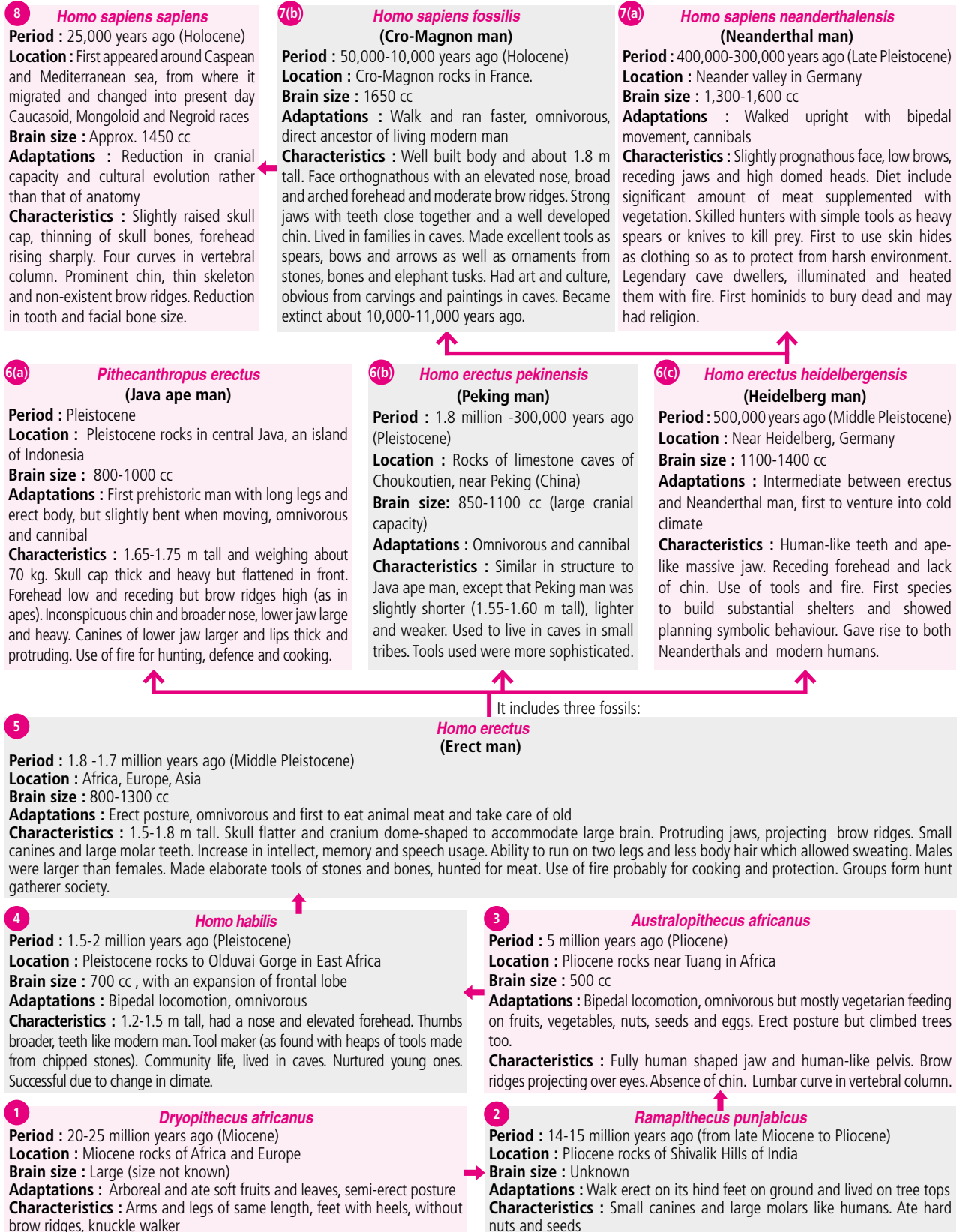
Spellathon

1. Make as many biological terms as possible using the given letters. Each word should contain the letter given in circle.
2. Minimum 4 letter word should be made.
3. In making a word, a letter can be used as many times as it appears in the box.
4. Make at least 1 seven letter word.

D I O N S T A C H K L
G P M T E R O S Y U

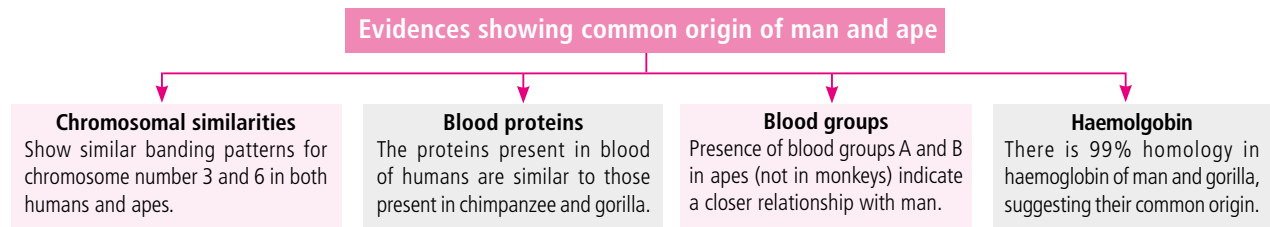
Send your response at editor@mtg.in or post to us with complete address by 25th of every month to win exciting prizes. Winner's name will be published in next issue.

EVOLUTION OF MAN



HOMOLOGY IN CHROMOSOMES OF MAN AND GREAT APES

- Each human somatic cells contains 46 chromosome (44 autosomes + 2 sex chromosomes) while each somatic cell of gorilla, chimpanzee, etc., has 48 chromosomes. The chromosomes obtained from a cell such as WBCs are treated with specific stains to produce banding patterns characteristic to specific chromosomes.
- The banding pattern suggests the structure of chromosomes and the comparison of banding patterns of individual chromosome of humans and apes.
- The banding patterns of human chromosome number 3 and 6 shows a common origin for man and chimpanzee.



SPEED PRACTICE

- Webbed toes of aquatic birds support
 - Neo-Lamarckism
 - Lamarckism
 - Darwinism
 - Neo-Darwinism.
- Identify the correct sequences in due course of organic evolution as proposed by Darwin and Wallace.
 - Overproduction, constancy of population size, struggle for existence, natural selection
 - Variations, survival of the fittest, constancy of population, overproduction, natural selection
 - Variations, natural selection, survival of the fittest, struggle for existence, overproduction
 - Overproduction, variations, constancy of population size, struggle for existence, natural selection
- Sympatric populations can be best identified as
 - two populations that are physically isolated by natural barriers
 - two populations that remain isolated but occasionally come together to interbreed
 - two populations that live together and freely interbreed to produce sterile offspring
 - two populations that share the same environment but cannot interbreed.
- According to Darwin, the 'survival of the fittest' indicates that
 - the strongest of all species survives
 - most intelligent of the species survives
 - the cleverest of species survives
 - the most adaptable of species survives.
- Variations in gene frequencies within populations can occur by chance rather than by natural selection. This phenomenon is referred to as
 - genetic drift
 - random mating
 - genetic flow
 - genetic load.
- Hugo de Vries' theory of mutation is
 - opposed to natural selection theory
 - not opposed to natural selection theory
 - opposed to germplasm theory
 - not opposed to Lamarck's theory.
- During industrial revolution in England, the black coloured peppered moth forms became dominant over the light coloured forms. This is due to
 - protective mimicry
 - inheritance of dark colour acquired due to darker environment
 - natural selection wherein dark forms are selected
 - poor sunlight which favours dark coloured forms.
- Which of the following evidences does not support the theory of natural selection?
 - Mimicry and protective colouration
 - Production of new varieties of plants and animals
 - Presence of vestigial organs
 - Correlation between nectaries of flowers and proboscis of insects

9. Read the following statements and select the correct option.
- Statement A :** Reproductive isolation gives rise to parapatric speciation.
- Statement B :** A physical barrier exists in parapatric speciation.
- (a) Both statements A and B are correct and B is the correct explanation of statement A.
 (b) Both statements A and B are correct but B is not the correct explanation of statement A.
 (c) Statement A is correct but statement B is incorrect.
 (d) Both statements A and B are incorrect.
10. Consider the following statements and choose the correct option.
- I. Increase in melanised moths after industrialisation in England is an example of artificial selection.
 II. When more individuals in a population acquire a mean character value, it is called disruption.
 III. Constant gene frequencies due to absence of gene flow leads to Hardy-Weinberg equilibrium.
 IV. Genetic drift changes the frequencies of alleles in a population.
- (a) I and III (b) II and IV
 (c) I and II (d) III and IV
11. The tendency of population to remain in genetic equilibrium may be disturbed by
- (a) lack of mutations (b) random mating
 (c) lack of random mating (d) lack of migration.
12. A species of a bird in coast of South America follows Hardy-Weinberg population principle for beak colour. Dominant phenotype is represented by a black beak, while the recessive phenotype is represented by grey beak. If half of the population carries recessive allele, what percentage of the birds have black beaks?
- (a) 25% (b) 50% (c) 75% (d) 100%
13. Match column I with column II and choose the right option.
- | Column I | Column II |
|----------------------------|----------------------------|
| I. Thomas Malthus | A. Branching descent |
| II. Hugo de Vries | B. Studies on populations |
| III. Charles Darwin | C. Use and disuse theory |
| IV. Lamarck | D. Saltation |
| (a) I-D, II-A, III-C, IV-B | (b) I-B, II-D, III-A, IV-C |
| (c) I-B, II-D, III-C, IV-A | (d) I-C, II-B, III-A, IV-D |
14. Select the incorrect statement regarding Peking man.
- (a) They had a cranial capacity ranging between 850-1100 cc.
 (b) They made excellent ornaments of elephant tusks.
 (c) They were omnivorous and cannibal.
 (d) They used to live in small groups or tribes.
15. The factors contributing towards post zygotic isolation in a population are
- (i) incompatibility (ii) seasonal isolation
 (iii) hybrid inviability (iv) hybrid sterility
 (v) mechanical isolation
- (a) (i), (ii) and (iv) only (b) (ii), (iii) and (v) only
 (c) (ii) and (v) only (d) (iii) and (iv) only
16. Darwin was influenced by Malthus' theory of human population which states that
- (a) population grows arithmetically when unchecked.
 (b) a balance between the population and environment is maintained due to competition for resources.
 (c) imbalance after a certain level in a population leads to crash caused by various factors such as hunger, floods, epidemics, etc.
 (d) none of these.
17. Identify the correct pre-historic man, from the given characteristics.
- (i) About 1.8 m tall with well built body.
 (ii) Broad and arched forehead with well developed chin.
 (iii) They could walk and run faster.
 (iv) They made excellent tools and cave paintings.
- (a) Cro-Magnon man (b) Neanderthal man
 (c) Heidelberg man (d) Java ape man
18. A small population of rats including approximately equal number of brown and white rats existed in a village on an island. After flooding, only a few rats managed to escape and survive while the entire population of rats in village was carried away. The population that grew thereafter, comprised of brown rats only, eliminating white rats completely. This phenomenon can be described as
- (a) founder effect (b) saltation
 (c) bottleneck effect (d) disruptive selection.
19. The apes are more closely related to humans than the new world monkeys and tarsiers. It can be best established by evidences obtained from
- (a) banding patterns of chromosome number 3 and 6.
 (b) 100% homology in haemoglobin of humans and apes.
 (c) both man and ape share only blood group A.
 (d) both (a) and (b).
20. Darwin's theory of Natural selection did not believe in role of which of the following in organic evolution?
- (a) Parasites and predators as natural enemies
 (b) Struggle for existence
 (c) Survival of the fittest
 (d) Discontinuous variations

ANSWER KEY

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (b) | 2. (a) | 3. (d) | 4. (d) | 5. (a) |
| 6. (b) | 7. (c) | 8. (c) | 9. (c) | 10. (d) |
| 11. (b) | 12. (c) | 13. (b) | 14. (b) | 15. (a) |
| 16. (c) | 17. (a) | 18. (c) | 19. (a) | 20. (d) |



MPP-9 MONTHLY Practice Problems

Class XII

This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.



• Biodiversity and Conservation

Total Marks : 160

Time Taken : 40 Min.

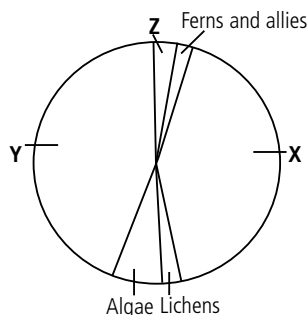
- Read the following statements and select the correct one.
 - Biodiversity is evenly distributed on earth.
 - Out of the total number of species present on the earth about 2.5 million species have so far been described.
 - Biodiversity hotspot is a region that shows high level of endemism and species richness.
 - Biodiversity refers to the totality of genes and species of a region.
- Match the column I with column II.

Column I	Column II
A. <i>Lantana camara</i>	(i) <i>Drosophila melanogaster</i>
B. 4000 genes	(ii) <i>Oryza sativa</i>
C. 13000 genes	(iii) <i>Cinchona ledgeriana</i>
D. Morphine	(iv) Exotic species
	(v) <i>Papaver somniferum</i>
	(vi) <i>Escherichia coli</i>

 - A-(iv), B-(iii), C-(i), D-(v)
 - A-(iv), B-(vi), C-(i), D-(v)
 - A-(ii), B-(iii), C-(vi), D-(v)
 - A-(ii), B-(iii), C-(i), D-(v)
- Which of the following statements is correct?
 - Increase in species diversity occurs as we ascend a high mountain.
 - Maximum diversity occurs in tropical Amazon rainforest.
 - Endemic species are restricted to a particular area or region.
 - Both (b) and (c).
- Which of the given pair of geographical areas in India show maximum biodiversity?
 - Rann of Kutch and Eastern ghats
 - Eastern himalayas and Western ghats
 - Western ghats and Gangetic plain
 - Sunderbans and Indo-Burma
- 'Rivet popper hypothesis' proposed by Paul Ehrlich describes the
 - effect of diversity on productivity
 - effect of alien species invasion
 - effect of decrease in biodiversity on the ecosystem
 - Both (a) and (b).
- Read the following statements and select the set of correct statements.
 - Maximum biodiversity occurs in tropical Amazon rainforest of South America.
 - β diversity refers to diversity within a community.
 - Extinction vortex is a combination of genetic and demographic factors.
 - Agenda 25, a product of Earth Summit, is a blue print for encouraging sustainable development of biodiversity through social, economic and environmental measures.
 - II only
 - I, II and IV only
 - I and III only
 - III and IV only
- Consider the graph showing species - area relationship and choose the incorrect statement related to it.

 - Relationship between species richness and area for a wide variety of taxa is a rectangular hyperbola.
 - Regression coefficient Z has generally a value of 0.1-0.2 regardless of taxonomic group or region.
 - Species area relationship curve was given by German naturalist and geographer Alexander von Humboldt.
 - Regression coefficient Z has a value of more than 2.0 for a very large area such as entire continent.

8. Choose the wrongly matched pair.
- Simplipal - Odisha
 - Periyar Sanctuary - Tiger
 - Khasi and Jaintia hills - Meghalaya
 - Khecheopalri - Sikkim
9. Read the following statements and select the correct option.
- Statement 1 :** National parks have been set up to protect wildlife.
- Statement 2 :** Biosphere reserves have greater importance than the national parks.
- Both statements 1 and 2 are correct and 2 is the correct explanation of 1.
 - Both statements 1 and 2 are correct but 2 is not the correct explanation of 1.
 - Statement 1 is correct but statement 2 is incorrect.
 - Both statements 1 and 2 are incorrect.
10. Identify labelled areas X, Y and Z from the given pie chart representing the proportion of global biodiversity of plants.



- X-Pteridophytes, Y-Gymnosperms, Z-Fungi
 - X-Angiosperms, Y-Gymnosperms, Z-Pteridophyte
 - X-Mosses, Y-Fungi, Z-Angiosperms
 - X-Angiosperms, Y-Fungi, Z-Mosses
11. Which of the following is incorrect regarding hotspots?
- High level of species richness
 - High level of endemism
 - It is *in situ* method of conservation
 - None of these
12. In the table given below the species richness and species equitability of five communities (I, II, III, IV and V) is shown.

Communities	Species richness	Species equitability
I	50	3
II	98	3
III	90	2
IV	88	8
V	85	7

Which communities has maximum and minimum diversity?

- Maximum diversity-III, minimum diversity-I
- Maximum diversity-III, minimum diversity-IV

- Maximum diversity-V, minimum diversity-III
- Maximum diversity-IV, minimum diversity-I

13. Which of the following statement is incorrect about α -diversity?
- It is dependent upon species richness and evenness.
 - It is the diversity present in range of communities.
 - There is lot of competition, adjustments and inter-relationships amongst members of the same community.
 - There are limited variations.
14. Which of the following group of plants are endangered in India?
- Diospyros celibica*, *Rhynia*, *Lotus corniculatus*
 - Petrocarpus santalinus*, *Nepenthes khasiana*, *Bentinckia nicobarica*
 - Lotus corniculatus*, *Petrocarpus santalinus*, *Berberis nilghiriensis*
 - Psilotum nudum*, *Berberis nilghiriensis*, *Cupressus cashmeriana*

15. Read the given statements and select the option which correctly identifies true (T) and false (F) ones.
- No human activity is allowed in the buffer zone of a biosphere.
 - Shannon index is a diversity index, commonly used in ecological studies.
 - Antelope cervicapra* and *Cupressus cashmeriana* are critically endangered species.
 - Bishnois of Rajasthan protect *Prosopis cineraria* and Black Buck religiously.

	I	II	III	IV
(a)	T	F	F	T
(b)	T	T	F	F
(c)	F	T	F	T
(d)	T	F	T	F

16. Which of the following is not included in evil quartet responsible for accelerated rate of species extinction?
- Overexploitation
 - Alien species invasion
 - Coextinction
 - Intensive agriculture
17. K-T boundary extinction is also known as
- natural extinction
 - mass extinction
 - anthropogenic extinction
 - none of these.
18. Nile Perch when introduced in lake Victoria of South Africa resulted in
- excessive growth of cichlid fish
 - elimination of water weeds
 - excessive growth of water weeds
 - elimination of native species of cichlid fish.
19. The forest within which the plants are located represents
- epsilon diversity
 - alpha diversity
 - beta diversity
 - gamma diversity.

20. An area is declared as "Hotspot" when
- it has 1500 or more endemic species and 75% of its original habitat is lost
 - it has 1500 or more vertebrate species and 75% of its original habitat is lost
 - it has more than 2000 species of plants
 - most of the species inhabiting the area is facing the risk of extinction.

21. India's only ape (*Hoolock gibbon*) is found in
- Gir National park
 - Corbett National park
 - Panna National park
 - Kaziranga Bird Sanctuary.

22. Read the given statements and select the correct option.

Statement 1 : *Ailurus fulgens* (Red panda) is an endangered species.

Statement 2 : It is at high risk of extinction in near future due to decrease in habitat and excessive poaching.

- Both statements 1 and 2 are correct and 2 is the correct explanation of 1.
- Both statements 1 and 2 are correct but 2 is not the correct explanation of 1.
- Statement 1 is correct but statement 2 is incorrect.
- Both statements 1 and 2 are incorrect.

23. Select the option that correctly fills the blanks.

- Arboreta is an example of _____ conversation.
- Total number of biodiversity hot spots in the world have been identified are _____ till date by Norman Myers.
- Preservation at _____ can maintain sperms, eggs, vegetatively propagated crops indefinitely.

	(i)	(ii)	(iii)
(a)	<i>in situ</i>	24	-130°C
(b)	<i>ex situ</i>	43	-155°C
(c)	<i>in situ</i>	44	-200°C
(d)	<i>ex situ</i>	34	-196°C

24. Which of the following is oldest established Biosphere reserve?

- Panna Biosphere reserve
- Nokrek
- Kachchh Biosphere reserve
- Sheshachalam hills

25. Which of the statements given below are incorrect?

- Cultivation of land is permitted in National Park.
 - Sanctuary is meant for protection of only fauna.
 - Cryopreservation is an example of *ex situ* conservation
 - Eastern ghats is a hotspot of biodiversity in India.
- I and II only
 - III and IV only
 - I and IV only
 - II and IV only

26. Match column I with column II and select the correct option from the codes given below.

Column I

- One horned rhinoceros
- Silent valley National park
- Nokrek biosphere reserve
- Lion-tailed Macaque

Column II

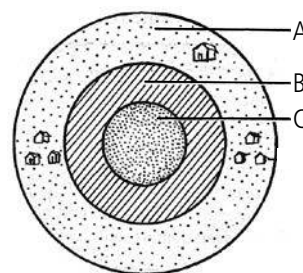
- Karnataka
- Mizoram
- Vulnerable species
- Endangered species
- Kerala
- Meghalaya

- A-(iii), B-(v), C-(vi), D-(iv)
- A-(iv), B-(v), C-(vi), D-(iii)
- A-(iv), B-(i), C-(ii), D-(iii)
- A-(iii), B-(i), C-(ii), D-(iv)

27. Most effective way to conserve plant diversity of a particular area is

- by creating botanical garden
- by tissue culture method
- by developing seed bank
- by creating biosphere reserve.

28. Read the given statements, (i-iii) and match with the labelled zones A, B and C in the figure.



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- (i) Active cooperation is present between reserve management and local people for settlements and cropping.
 (ii) In this region limited human activity is allowed.
 (iii) This area is undisturbed and legally protected ecosystem.

	(i)	(ii)	(iii)
(a)	B	A	C
(b)	A	C	B
(c)	A	B	C
(d)	C	B	A

29. Five species (i) to (v) sampled in four areas A-D given below. Which of the following areas has maximum biodiversity? (Note: '+' symbol is used for Present and '-' is used for Absent).

	(i)	(ii)	(iii)	(iv)	(v)
A.	+	-	+	-	+
B.	+	+	+	+	+
C.	+	+	-	+	+
D.	-	+	-	+	+
(a)	A			(b)	B
(c)	C			(d)	D

30. Select the incorrectly matched pair.

- (a) *In situ* conservation – sacred groves
 (b) Savanna – *Acacia* tree
 (c) Hangul project – Bandipur National park
 (d) Wildlife protection act – 1972

31. Match the column I with column II.

Column I	Column II
A. Gandhi Zoological Park	(i) Andhra Pradesh
B. Kamala Nehru Zoological Park	(ii) Madhya Pradesh
C. National Zoological Park	(iii) West Bengal
D. Sri Venkateswara Zoological Park	(iv) Gujarat
E. Padmaja Naidu Himalayan Zoological Park	(v) Delhi
(a) A-(i), B-(v), C-(iv), D-(ii), E-(iii)	
(b) A-(ii), B-(iv), C-(v), D-(i), E-(iii)	
(c) A-(ii), B-(iii), C-(iv), D-(i), E-(v)	
(d) A-(i), B-(iv), C-(ii), D-(iii), E-(v)	

32. Maximum amphibian species are endemic in which biogeographical region of India?

- (a) North-East (b) Western ghats
 (c) Gangetic plain (d) Islands

33. More diversity is generated where there is
 (a) co-extinctions (b) over exploitation
 (c) heterogeneity (d) both (b) and (c).

34. Biogeographical region where a large number of cultivated plants originated is
 (a) desert (b) Deccan peninsula
 (c) Gangetic plain (d) North-East region.

35. Tiger is not protected in which one of the following National Parks?
 (a) Sunderbans (b) Gir
 (c) Jim Corbett (d) Bandipur

36. Which one of the following is not a wildlife conservation project?
 (a) Project Dodo (b) Project great Indian Bustard
 (c) Project Tiger (d) Project Hangul

37. Oran is a
 (a) sacred grove (b) sacred landscape
 (c) sacred animal (d) endangered animal.

38. Which of the following statements is correct?
 (a) Species diversity, in general, increases from poles to the equator.
 (b) Species evenness is the number of species per unit area.
 (c) India's share of global species diversity is about 18%.
 (d) There are about 25000 known species of plants in India.

39. Genetic diversity in agricultural crops is mostly threatened by
 (a) introduction of high yielding varieties
 (b) intensive use of fertilisers
 (c) extensive intercropping
 (d) intensive use of biopesticides.

40. Select the correct statement about biodiversity.
 (a) Biodiversity of a geographical region represents endangered species found in the region.
 (b) Large scale planting of Bt cotton has no adverse effect on biodiversity.
 (c) Western ghats have a very high degree of species richness and endemism.
 (d) Algae represent maximum number of species among global biodiversity.



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SELF CHECK



Check your score! If your score is

No. of questions attempted	> 90%	EXCELLENT WORK !	You are well prepared to take the challenge of final exam.
No. of questions correct	.....	90-75%	GOOD WORK !	You can score good in the final exam.
Marks scored in percentage	.....	74-60%	SATISFACTORY !	You need to score more next time.
		< 60%	NOT SATISFACTORY!	Revise thoroughly and strengthen your concepts.

CBSSE BOARD

UNIT - V

- Organisms and Populations
- Ecosystem
- Biodiversity and Conservation
- Environmental Issues

UNITWISE PRACTICE PAPER 2018

GENERAL INSTRUCTIONS

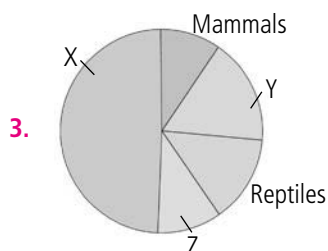
- All questions are compulsory.
- This question paper consists of five sections A, B, C, D and E. Section A contains 5 questions of one mark each, Section B contains 5 questions of two marks each, Section C contains 12 questions of three marks each, Section D contains 1 question of VBQ type with four marks and Section E contains 3 questions of five marks each.
- There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.
- Wherever necessary, the diagrams drawn should be neat and properly labelled.

Time Allowed : 3 hours

Maximum Marks : 70

SECTION - A

- Define standing crop and standing state.
- Write two different ways for the disposal of e-wastes.



Name the labelled parts X, Y and Z in the pie chart (given above) representing the global biodiversity of vertebrates showing the proportionate number of species of major taxa.

- Ecology is basically concerned with four levels of biological organisation. Name them.
- In a pond, there were 40 lotus plants. If 10 lotus plants died in a week, reducing the current population to 30, then calculate the death rate of lotus population for the said period.

SECTION - B

- What type of interaction is seen between fig and wasp? Explain.

- Write any four measures that can control vehicular air pollution in cities.
- Differentiate between *in situ* and *ex situ* conservation.

OR

State differences between net primary productivity and gross primary productivity.

- Name the interaction in each of the following:
 - Calotropis* producing highly poisonous chemicals
 - Pilot fish accompanies shark
 - Pluvianus* enters the open mouth of crocodile
 - Association of *Anabaena* with *Azolla*
- The pyramid of energy is always upright. Justify the statement.

SECTION - C

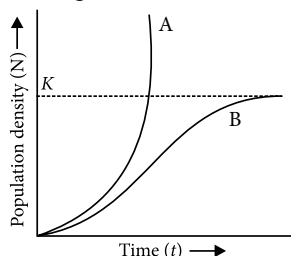
- With the help of a flow chart, describe the phenomenon of biomagnification of DDT in an aquatic food chain.
- David Tilman proved experimentally that stability of a community depends on its species richness. Explain.
- Explain how does a primary succession start on a bare rock and reach a climax community.
- Enumerate how human activities cause desertification.

15. What are the causes of global warming? Also explain why is it a warning to mankind.

OR

Compare narrowly utilitarian and broadly utilitarian approaches to conserve biodiversity with the help of suitable examples.

16. Study the population growth curves shown below.



- Identify curves A and B.
 - Mention the conditions responsible for the curves A and B respectively.
 - Give the necessary equation for the curve B.
17. Differentiate between xerarch and hydrarch succession.
18. Construct a pyramid of energy when 10,000 joules of energy is available at the producer level. Label all its trophic levels.
19. (a) Name the two types of nutrient cycle existing in nature. Where are their reservoirs present? State the functions of reservoirs.
(b) Explain the two ways by which carbon is returned to the atmosphere.
20. (a) Name the two metals used in a catalytic converter that help in keeping the environment clean.
(b) Lichens are regarded as pollution indicators. Explain.
21. (a) Differentiate between grazing and detritus food chain.
(b) Herbivores are considered similar to predators in the ecological context. Explain.
22. Define the following:
(a) Allen's rule (b) Photochemical smog
(c) Diapause (d) Hotspots

SECTION - D

23. Rekha was waiting at a bus stop. Many passengers along with their kids were on the way to school. A bus passing by, ejected dark black smoke from the exhaust pipe. Rekha immediately stopped the bus and called the conductor and driver to show what they were contributing to the environment. Passengers waiting at the bus stop supported Rekha. She explained the driver about use of CNG and catalytic converters which help in reduction of vehicular emission.
- Why one should use CNG instead of petrol or diesel?
 - How do catalytic converters reduce vehicular gas emission?
 - We often see some cars with Bharat stage IV stickers. What does it imply?
 - What values are shown by Rekha through her action?

SECTION - E

24. (a) How does the algal bloom choke the water body in an industrial area?
(b) What preventive measures should be taken to stop algal bloom?
(c) Why *Eichhornia crassipes* is also known as "Terror of Bengal"?

OR

With the help of a simplified model, explain how carbon cycle is a biogeochemical event occurring in nature.

25. What are the different ways by which organisms manage with abiotic stresses in nature?

OR

- Explain why is the ozone layer required in the stratosphere. How does it get depleted?
- How ozone depletion is a threat to mankind?

26. Enumerate the advantages of a healthy ecosystem.

OR

How does a hydrarch succession progresses from hydric to mesic condition to form a stable climax community?

SOLUTIONS

- Standing crop is the amount of living matter present in a unit area of an ecosystem or biome. Standing state is the amount of biogenetic or inorganic matter present in the abiotic environment at any given time.
- Incineration and landfilling
- X - Fish, Y - Birds, Z - Amphibians
- (i) Organisms (ii) Populations
(iii) Communities (iv) Biomes
- Lotus plants in the pond = 40
Plant died in a week = 10
Death rate of lotus population = $\frac{\text{Plants died}}{\text{Total number of plants}} = \frac{10}{40}$
= 0.25 individuals per lotus plant per year
- Mutualism is found between fig and wasp as both are beneficial for each other with none of the two capable of living separately. The fig species can be pollinated only by its partner wasp species and not other species. The female wasp uses the fruit not only as an oviposition (egg-laying) site but uses the developing seeds within the fruit for nourishing its larvae. The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites. In return for the favour of pollination, the fig offers the wasp some of its developing seeds as food for the developing wasp larvae.
- The four measures that can control vehicular air pollution in cities are as follows :
(i) Use of CNG as fuel in the vehicles because it burns more efficiently and is also cheaper
(ii) Use of unleaded petrol
(iii) Use of catalytic converter in the vehicles as it reduces emission of poisonous gases

(iv) Application of stringent pollution level norms for vehicles

8. Differences between *in situ* and *ex situ* conservation are as follows:

	<i>In situ</i> conservation	<i>Ex situ</i> conservation
(i)	It is the conservation of endangered species in their natural habitats.	It is the conservation of endangered species outside their natural habitats.
(ii)	The endangered species are protected from predators.	The endangered species are protected from all adverse factors.
(iii)	The population recovers in natural environment.	Offspring produced in captive breeding are released in natural habitat for acclimatisation.

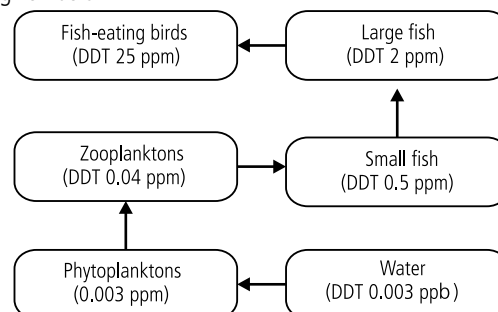
OR

Differences between net primary productivity and gross primary productivity are as follows :

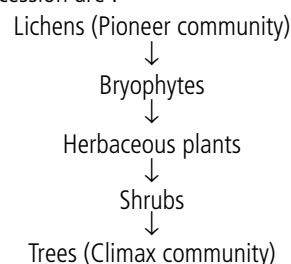
	Net primary productivity	Gross primary productivity
(i)	It is the amount of organic matter stored by producers per unit time per unit area.	It is the amount of organic matter synthesised by producers per unit time per unit area.
(ii)	Net primary productivity is equal to organic matter synthesised by photosynthesis minus utilisation in respiration and other losses.	Gross primary productivity is equal to rate of increase in body weight of producers plus loss suffered through respiration and damages.
(iii)	It depends upon gross primary productivity as well as amount of consumption of photosynthates.	It depends upon photosynthetic efficiency of producers, availability of solar energy as well as organic nutrients.

9. (a) Predation (b) Commensalism
(c) Protocooperation (d) Mutualism
10. The pyramid of energy is always upright in shape as there is always a gradual decrease in the energy content at successive trophic levels from producers to various consumers. This is because some energy is used at each trophic level for various metabolic activities and some energy is lost as heat, so only 10% of the energy is available to the next trophic level (Lindeman's 10% law).
11. DDT is a pesticide that keeps on moving from water to different living components of the ecosystem in an aquatic food chain. DDT passes into food chain and increase in amount per unit weight of organisms with the rise in trophic level due to their

accumulation in fat. This phenomenon is known as biological magnification or biological amplification. The flow chart showing biomagnification of DDT in an aquatic food chain is given below:



12. Communities with more species tend to be more stable than those with less species as it is able to resist occasional disturbance. This has been confirmed experimentally by David Tilman. He raised plots with different diversities in Minnesota grassland and subjected them to various stresses so as to carry out long term ecosystem experiments. He found that plots with more species showed less year to year variation in total biomass. He also showed in his experiments, that increased diversity contributed to higher productivity.
13. Xerarch succession occurs on bare rocks. The habitat lacks soil, has intense light, fluctuations of temperatures and winds. The species that invade a bare area are called pioneer species. In primary succession on rocks, lichens are usually the pioneer species which are able to secrete acids to corrode rock surface and thus, helping in weathering and soil formation. These pave the way for some small plants like bryophytes, which are able to take hold in the small amount of soil. They are, with time, succeeded by herbs stage, followed by shrub stage and then bigger plants, and ultimately a stable climax community, *i.e.*, forest is formed. The climax community remains stable as long as the environment remains unchanged. With time, the xerophytic habitat gets converted into a mesophytic one. The steps in xerarch succession are :



14. Loss of soil productivity by erosion of top soil results in the desert formation. Deserts are spreading in all continents, destroying the fertile land. Various human activities that cause desertification are:
- (i) Human establishment : Forest areas have been cleared for building more residential complexes and industrial townships for ever increasing human population.

- (ii) Overgrazing : The livestock graze in forest trampling seedlings and cause soil compaction. This reduces water storing capacity and increases run off.
- (iii) Requirement of wood for timber and paper industry results in clearing of forest land which leads to soil erosion resulting in the desert formation.

15. The main causes of global warming are:

- (i) Deforestation
- (ii) Increase in the use of CFCs
- (iii) Burning of fossil fuels
- (iv) Increase in the use of nitrogen fertilisers

Global warming is a warning to mankind because:

- (i) Rise in temperature is leading to increased melting of polar ice caps as well as of other places like the Himalayan snow caps. This will result in a rise in sea level that can submerge many coastal areas.
- (ii) Changes in the environment results in odd weather and climate changes, e.g., El Nino effect.
- (iii) Many tree species and others which are sensitive to temperature will die out resulting in conversion of forests into scrub vegetation.
- (iv) Small temperature rise may increase crop productivity in temperate areas but higher temperature rise will be detrimental.

OR

There are a number of reasons to conserve biodiversity which can be grouped as:

- (a) Narrow utilitarian : Humans derive a major part of their requirement from organisms. Their direct benefits are countless like (i) food, cereals, pulses, fruits, vegetables, milk, egg, meat comes from plants and animals, (ii) fats and oils are obtained from plants and animal, (iii) firewood as a source of energy for cooking and heating, (iv) fibres, e.g., cotton, flax, silk, wool. (v) industrial products like tannins, lubricant dyes, resins, and perfumes and (vi) drugs: Nearly 25% of drugs being used by us are directly coming from plants.
- (b) Broadly utilitarian : Biodiversity is fundamental to ecosystem services of nature. For example, (i) Oxygen: Through their photosynthetic activity plants are replenishing oxygen of the atmosphere. Amazon rainforest is estimated to contribute 20% of it. (ii) Pollination: Bees, bumble bees, butterflies, moths, beetles, birds and bats are engaged in pollination of plants which is essential for formation of fruits and seeds. (iii) Climate regulation: Forest and oceanic systems regulate global climate. (iv) Aquifers: Plant cover is essential for retention of rainwater, its percolation and storage in aquifers and reservoirs. (v) Flood and erosion control: Plant cover protects the soil from wind and water erosion. Run off of rainwater

is reduced so that flood water is rarely formed. (vi) Nutrient cycling : It is essential for continued availability of nutrients to plants without which there would be no photosynthetic activity.

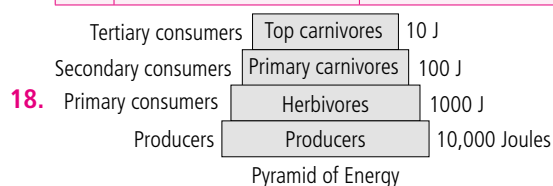
16. (a) Growth curve A represents the J-shaped or exponential growth while growth curve B represents S-shaped or logistic growth.

(b) For curve A, population growth is not limited by the resources whereas for curve B resources limit the population growth.

(c) Equation for curve B is $\frac{dN}{dt} = rN \left(\frac{K - N}{K} \right)$

17. Differences between xerarch and hydrarch succession are as follows:

	Xerarch succession	Hydrarch succession
(i)	It begins with lichens or blue green algae.	It begins with phytoplanktons.
(ii)	Initial succession is a slow process.	Initial succession is quite fast.
(iii)	Succession is seen all over the area.	Succession is observed in area where water is not very deep.
(iv)	The whole of the area is involved in formation of climax community.	Climax community develops on the edge only.
(v)	Succession converts xeric environment into mesic environment.	It converts aquatic environment into mesic environment.
(vi)	It reduces bare land area and converts it into fertile forested area.	It fills up water body and changes it into forested land.



19. (a) Two types of nutrient cycle existing in nature are gaseous and sedimentary. Atmosphere and lithosphere are reservoirs for gaseous and sedimentary cycle respectively. The function of reservoir is to meet deficiency of nutrients which occurs due to difference in rate of influx and efflux.

(b) The two ways by which carbon is returned to the atmosphere are:

- (i) By respiration of all living organisms: During respiration, all living organisms release carbon dioxide which returns to atmosphere thereby replenishing its amount in the atmosphere.

- (ii) By burning of fossil fuels: Fossil fuels like coal, petroleum and natural gas are rich source of carbon. On burning, they release carbon in the form of carbon dioxide back into the atmosphere.

20. (a) Metals used in catalytic converters that help in keeping the environment clean are platinum- palladium and rhodium.

(b) Lichens are very sensitive to pollution, especially caused by SO_2 . Air polluted with SO_2 and acid rain, destroy lichen population. Hence, lichens are regarded as pollution indicators.

21. (a) Differences between grazing food chain and detritus food chain are as follows:

	Grazing food chain	Detritus food chain
(i)	The food chain begins with producers at the first trophic level.	The food chain begins with detritivores and decomposers at the first trophic level.
(ii)	Energy for the food chain comes from sun.	Energy for the food chain comes from organic remains or detritus.

(b) In ecological context, herbivores are considered similar to predators because they feed on plants and their products for their food requirements just like predators feed on prey for their food needs.

22. (a) Mammals from colder climates generally have shorter ears and limbs to minimise heat loss. This is called as the Allen's rule.

(b) Photochemical smog is composed of secondary air pollutants. It is formed by interaction of hydrocarbons with nitrogen oxides. The products are ozone, peroxyacyl nitrate (PAN), aldehydes and phenols.

(c) Diapause is a stage of suspended development, which is exhibited by many zooplankton species in lakes and ponds, under unfavourable conditions.

(d) Biodiversity hotspots are the regions which are characterised by very high levels of species richness and high degree of endemism. India has three hotspots – Indo-Burma (North-East India), Eastern Himalayas, and Western Ghats.

23. (a) CNG (Compressed natural gas) is a better fuel than petrol or diesel because it is (i) cheaper (ii) burns more efficiently, (iii) does not produce much pollution, (iv) cannot be siphoned off by thieves and (v) cannot be adulterated like petrol and diesel. The major problem of CNG is laying down of pipes to ensure uninterrupted supply of CNG to CNG pumps or distribution points.

(b) Catalytic converters, having expensive metals namely platinum-palladium and rhodium as the catalysts,

are fitted into automobiles for reducing emission of poisonous gases. As the exhaust passes through the catalytic converter, unburnt hydrocarbons are converted into carbon dioxide and water, and carbon monoxide and nitric oxide are changed to carbon dioxide and nitrogen gas, respectively. Vehicles equipped with catalytic converter should use unleaded petrol because lead in the petrol inactivates the catalyst.

(c) Cars seen with Bharat stage IV stickers implies that the vehicles are complied with the new auto fuel policy to reduce vehicular pollution. Bharat stage IV norms are implemented in 13 mega cities of India.

(d) Rekha shows alertness, awareness, responsibility and firmness in tackling a problem. She had the knowledge about vehicular norms which she applied in a correct situation.

24. (a) The nutrient enrichment of water bodies near industrial area is due to passage of industrial effluents, sewage, etc. This cause dense growth of planktonic algae, that results in colouration of water called algal bloom. Excessive growth of it cut off light for submerged plants which kills the latter and causes organic loading. This leads to decreased oxygen level which eventually chokes the water body.

(b) Organic waste and other types of waste material should not be dumped into the pond. Domestic wastes with organic nutrients must be treated before passing into it.

(c) *Eichhornia crassipes* is also called as "Terror of Bengal" because it is an exotic shrub which strongly competes with the native species and has also eliminated many of them. It has beautiful flowers but it sometimes chokes ponds, lakes, wetlands and rivers resulting in imbalance of ecosystem of water bodies and causes death of many aquatic species of India. It also increases biochemical oxygen demand of the water body.

OR

Refer to answer 74, page 370, MTG CBSE Champion.

25. Refer to answer 114, page 350, MTG CBSE Champion.

OR

(a) Refer to answers 84 and 82 (a), page 409, MTG CBSE Champion.

(b) Refer to answer 86 (b), page 409, MTG CBSE Champion.

26. Refer to answer 82, page 371, MTG CBSE Champion.

OR

Refer to answer 65 (a), page 368, MTG CBSE Champion.



PMT

TRANSPORT IN PLANTS

This paper contains 50 **multiple choice questions**. Each question has four choices (a), (b), (c) and (d), out of which **ONLY ONE** is correct. (Mark only one choice).

Marks : $50 \times 4 = 200$

Negative Marking (-1)

- Glucose is not stored in plant due to
 - decrease in osmotic pressure
 - increase in osmotic pressure
 - increase in turgor pressure
 - decrease in turgor pressure.
- All of the following statements are true except
 - Most herbaceous plant has 10-15% body weight as dry weight.
 - Water is often a limiting factor for plant growth and productivity in agriculture.
 - Water potential of pure water is zero if it is under external pressure.
 - Water channels in cell membrane are formed of 8 different types of aquaporins.
- Which of the following is true regarding osmotic pressure?
 - It develops only in a confined system.
 - Minimum pressure which must be applied on osmotically active solution just to prevent endosmosis in it.
 - Maximum possible pressure which may develop in an osmotically active solution due to endosmosis.
 - All of these
- Hydrous cobalt chloride paper appears as
 - pink
 - blue
 - orange
 - green.
- Transpiration driven ascent of xylem sap depends mainly on which of the following physical properties of water?
 - Cohesion
 - Surface tension
 - Diffusion in gaseous phase only
 - Both (a) and (b)
- Translocation of food in phloem can be explained by
 - pressure flow hypothesis
 - cohesion and tension theory
 - classical starch hypothesis
 - all of these.
- For translocation of food, sugar is transferred to sieve tubes from mesophyll cells by
 - facilitated diffusion
 - passive absorption
 - active transport
 - diffusion.
- Which of the following is a wrong statement?
 - Lenticular transpiration accounts is for < 1% of total transpiration.
 - 'Transpiration is a necessary evil' stated by Curtis.
 - Translocation of food is unidirectional.
 - Guttation takes place early in the morning when transpiration is lower than water absorption in some herbaceous plants.
- Which of the following condition favours closure of stomata?
 - Increase in pH and ABA
 - Development of absorption lag
 - Increase in pH and increase in concentration of CO_2
 - Increase in pH and decrease in O.P. of guard cells
- What would be the ψ_p of a fully flaccid cell?
 - 3
 - 1
 - zero
 - +3
- The main form of sugar transported through phloem is
 - glucose
 - fructose
 - sucrose
 - ribose.
- When a cell is fully turgid, which of the following will be zero?
 - Turgor pressure
 - Wall pressure
 - Water potential
 - Osmotic pressure (solute pressure)
- How many of the following statements are true?
 - Osmosis is passage of solutes through semipermeable membrane from decrease in DPD to increase in DPD.
 - Osmotic pressure is higher in halophytes than xerophytes.
 - Egg membrane and cellophane paper are selectively permeable membranes.
 - If a cell kept in a solution increases in size, then the solution will be hypertonic.
 - 1M NaCl has higher ψ_w as compared to 1M sucrose.
 - 4
 - 3
 - 2
 - 1

14. Which of the following is used to determine the rate of transpiration in plants?
 (a) Porometer (b) Potometer
 (c) Auxanometer (d) Tensiometer
15. Water drops present on leaf margins of *Tropaeolum*, Balsam and grasses in early morning are due to
 (a) bleeding (b) high root pressure
 (c) osmosis (d) transpiration.
16. In which of the following plants would metabolism be hindered if the leaves are coated with wax on their upper surface?
 (a) *Hydrilla* (b) Lotus (c) *Potamogeton* (d) *Vallisneria*
17. Transpiration is least at
 (a) good soil moisture
 (b) high wind velocity during storm like condition
 (c) dry environment (d) afternoon.
18. In soil, the water available for absorption through root is
 (a) gravitational water (b) capillary water
 (c) hygroscopic water (d) combined water.
19. Supply of excess fertiliser and watering of a grass lawn causes browning of grass leaves due to
 (a) decreased photosynthesis
 (b) water logging of soil
 (c) leaching of fertiliser to lower soil strata
 (d) exosmosis and death of root.
20. During absorption of water by roots, the water potential of cell sap is lower than that of
 (a) pure water and soil solution
 (b) neither pure water nor soil solution
 (c) pure water but higher than that of soil solution
 (d) soil solution but higher than that of pure water.
21. A twig dipped in water, having small amount of salt, from its cut end remains fresh for longer period due to
 (a) decrease in bacterial degradation
 (b) exosmosis
 (c) decrease in photosynthetic rate
 (d) absorption of more water.
22. Potato slices were placed in sucrose solution. After half an hour, density of sucrose solution increased. Water potential of potato tuber is
 (a) equal to solute potential of sucrose solution
 (b) greater than solute potential of sucrose solution
 (c) less than solute potential of sucrose solution
 (d) half the concentration of sucrose solution.
23. Match column I with column II and select the correct option from codes given below.
- | Column I | Column II |
|-------------------------|--|
| A. Girdling experiment | (i) Demonstrate transpiration pull |
| B. Cobalt chloride test | (ii) Transpiration |
| C. Atmometer | (iii) Use to compare transpiration from two surfaces |
| D. Bell jar experiment | (iv) Translocation in phloem |
- (a) A-(iv), B-(i), C-(ii), D-(iii)
 (b) A-(iv), B-(iii), C-(i), D-(ii)
 (c) A-(ii), B-(i), C-(iv), D-(iii)
 (d) A-(iii), B-(i), C-(iv), D-(ii)
24. Main function of lenticels and stomata is
 (a) transpiration (b) guttation
 (c) gaseous exchange (d) both (a) and (b).
25. Choose the correct sequence of events during wilting.
 (a) Exosmosis, deplasmolysis, temporary wilting, permanent wilting
 (b) Exosmosis, plasmolysis, temporary wilting, permanent wilting
 (c) Endosmosis, plasmolysis, temporary wilting, permanent wilting
 (d) Exosmosis, temporary wilting, deplasmolysis, permanent wilting
26. Osmotic pressure of a solution is
 (a) more than that of pure solvent
 (b) less than that of pure solvent
 (c) equal to that of pure solvent
 (d) none of these.
27. Sunken stomata occur in the leaves of
 (a) *Cycas* (b) *Nerium* (c) *Pinus* (d) all of these.
28. Which one is responsible for opening of stomata?
 (a) Decrease in CO_2 concentration and increase in H^+ ion concentration
 (b) Decrease in CO_2 concentration and decrease in H^+ ion concentration
 (c) Increase in CO_2 concentration and increase in H^+ ion concentration
 (d) More free H^+ ions and less Cl^- ions
29. A cell is said to be flaccid when
 (a) it has no water in vacuole
 (b) $\text{TP} = \text{OP}$ (c) DPD is strongly -ve
 (d) water flow into the cell and out of the cell is in equilibrium.
30. Which of the following statement is true regarding Ψ_w ?
 (a) $\Psi_w = 0$, if pure water is applied with pressure of 100 bars.
 (b) $\Psi_w = \Psi_s + \Psi_p$ for a partially turgid cell.
 (c) $\Psi_w = \Psi_s$ for a fully turgid cell.
 (d) $\Psi_w = \Psi_s - \Psi_p$ when cell is fully flaccid.
31. π symbol is used to denote
 (a) turgor pressure (b) osmotic pressure
 (c) diffusion pressure deficit (d) osmotic potential.
32. Select the correct event leading to stomatal opening.
 (i) Decline in solutes in guard cells
 (ii) Increased wall pressure of guard cells
 (iii) Rise in K^+ ions in guard cells
 (iv) Movement of water from neighbouring cells into guard cells
 (v) Guard cells become flaccid.
 (a) (i) and (v) only (b) (ii), (iii) and (iv) only
 (c) (i), (iii) and (iv) only (d) (ii), (iv) and (v) only

33. Select the correct ones.
 (i) Apoplastic movement of water occurs exclusively through cell wall.
 (ii) Solutes increase free energy of water or water potential.
 (iii) Symplastic movement occurs through plasmodesmata.
 (iv) Membrane permeability depends upon membrane composition as well as chemical nature of solute.
 (a) (i) and (ii) only (b) (ii) and (iv) only
 (c) (i), (iii) and (iv) only (d) (i), (ii) and (iv) only
34. Guttation occurs when
 (a) wind velocity is high and low water available in soil
 (b) humidity increases in environment and no available water in soil
 (c) root pressure is less and transpiration rate is more
 (d) root pressure is more and transpiration rate is less.
35. Downward movement of organic and inorganic solutes from leaves occurs through
 (a) phloem by diffusion
 (b) phloem by protoplasmic streaming
 (c) parenchymatous cells by diffusion
 (d) phloem by mass flow.
36. The loss of which will harm the tree most?
 (a) Bark (b) Half the leaves
 (c) Half the branches (d) All the leaves
37. For the same amount of CO_2 fixed, a C_4 plant as compared to C_3 plant loses only
 (a) half the amount of water (b) double amount of water
 (c) equal amount of water (d) none of these.
38. Rate of transpiration is high in
 (a) wheat (b) maize (c) *Opuntia* (d) *Sorghum*.
39. When half the leaves are removed randomly, transpiration will show
 (a) higher magnitude but lower flux or rate per unit
 (b) lower magnitude but higher flux
 (c) both magnitude and flux increase
 (d) both magnitude and flux decrease.
40. An antitranspirant is
 (a) cobalt chloride (b) mercury
 (c) potassium (d) aspirin.
41. Transpiration increases in
 (a) hot, damp and windy conditions
 (b) cool, damp and windy conditions
 (c) cool, dry and still conditions
 (d) hot, dry and windy conditions.
42. Passive absorption of water occurs due to
 (a) hydrostatic pressure in root
 (b) tension in xylem sap
 (c) ATP (d) none of these.
43. In order to demonstrate root pressure, the plant is given a cut at
 (a) the tip
 (b) transition zone
 (c) a few centimeters above the soil
 (d) a few centimeters below the soil.
44. Arrange root hair cell, inner cortical cell and mesophyll cell in descending order of Ψ_w .
 (a) Mesophyll cell, root hair cell and cortical cell
 (b) Cortical cell, mesophyll cell and root hair cell
 (c) Root hair cell, cortical cell and mesophyll cell
 (d) Root hair cell, mesophyll cell and cortical cell
45. In soil, the water available for root absorption is
 (a) holard (b) chresard
 (c) echard (d) combined water.
46. Which of the following is correct pathway of water movement plants?
 (a) Soil \rightarrow Root hair \rightarrow Cortex \rightarrow Endodermis \rightarrow Pericycle \rightarrow Metaxylem \rightarrow Protoxylem
 (b) Soil \rightarrow Root hair \rightarrow Endodermis \rightarrow Cortex \rightarrow Pericycle \rightarrow Metaxylem \rightarrow Protoxylem
 (c) Soil \rightarrow Root hair \rightarrow Cortex \rightarrow Endodermis \rightarrow Pericycle \rightarrow Protoxylem \rightarrow Metaxylem
 (d) Soil \rightarrow Root hair \rightarrow Pericycle \rightarrow Endodermis \rightarrow Cortex \rightarrow Protoxylem \rightarrow Metaxylem
47. Plant cells dipped in distilled water will become
 (a) turgid (b) plasmolysed
 (c) flaccid (d) impermeable.
48. Which of the following is false regarding facilitated diffusion?
 (a) Show transport saturation
 (b) Uphill transport
 (c) Effected by protein poisons
 (d) Passive process
49. Purple cabbage leaves do not loose anthocyanin in cold water but do so in hot water because
 (a) hot water enters the cells faster
 (b) pigment is not soluble in cold water
 (c) hot water destroys cell walls
 (d) hot water kills plasma membrane and makes it permeable.
50. Osmosis involves movement of
 (a) solute particles from higher concentration to lower concentration
 (b) solvent particles from lower water potential to higher water potential
 (c) solute particles from lower concentration to higher concentration
 (d) solvent particles from higher water potential to lower water potential.

ANSWER KEY

1. (b)	2. (c)	3. (d)	4. (a)	5. (d)
6. (a)	7. (c)	8. (c)	9. (b)	10. (c)
11. (c)	12. (c)	13. (c)	14. (b)	15. (b)
16. (b)	17. (b)	18. (b)	19. (d)	20. (a)
21. (d)	22. (b)	23. (b)	24. (c)	25. (b)
26. (a)	27. (d)	28. (b)	29. (d)	30. (b)
31. (b)	32. (b)	33. (c)	34. (d)	35. (d)
36. (a)	37. (a)	38. (a)	39. (b)	40. (d)
41. (d)	42. (b)	43. (c)	44. (c)	45. (b)
46. (c)	47. (a)	48. (b)	49. (d)	50. (d)

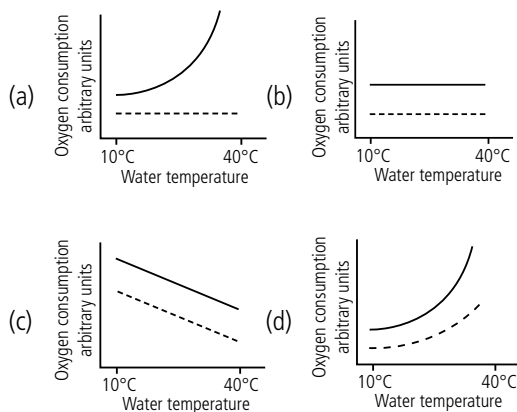
BIOLOGY

OLYMPIAD PROBLEMS

1. Two statements regarding evolution are made below.
- Rates of evolution are typically very slow because natural selection is usually P selection.
 - The plant population growing on high-zinc-soil is able to grow at concentrations which are otherwise lethal to plants of the same species. This is Q selection. P and Q refer to
- directional and disruptive selection respectively
 - stabilising and directional selection respectively
 - directional selection
 - stabilising selection.

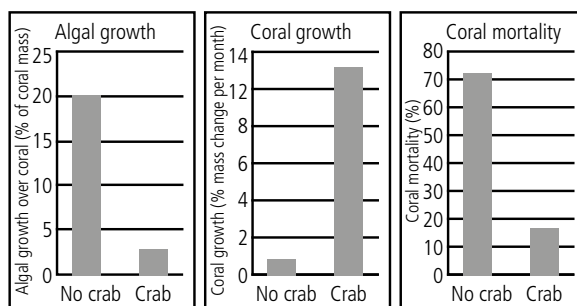
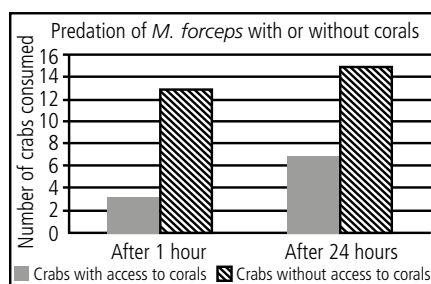
(INBO 2017)

2. Fish utilise oxygen dissolved in water. When the temperature of water rises, it can pose physiological stress to the fish as solubility of oxygen in water decreases. Which of the following graphs correctly depicts the oxygen consumption rates of resting fish and active fish under these conditions?



(INBO 2016)

3. An experiment to understand the relationship between a herbivorous crab *Mithrax forceps* and the coral *Oculina arbuscula* was undertaken in a shallow water coastal ecosystem. Observation on predation of crab, growth of algae, growth and mortality of corals were made. The following graphs indicate the results obtained during the experiment.



A few statements based on the results obtained are made.

- The presence of crabs has a negative influence on algal growth and positive influence on coral growth.
- Presence of *M. forceps* is obligatory for the survival of *O. arbuscula*.
- The coral species plays an important role in preventing predation of *M. forceps*.
- The algae outcompete *O. arbuscula* in the absence of *M. Forceps*.

Which of these statements are true?

- i, ii and iii only
- i and iv only
- i, iii and iv only
- iii and iv only

(INBO 2016)

4. Animals belonging to the following groups are usually hermaphrodites except
- gastropods
 - oligochaetes
 - crustaceans
 - flatworms.

(NSEB 2015-16)

5. Which of the following individuals will produce 16 types of gametes?

- AaBbccDdeeFF
- AaBbccDDEeFf
- AaBbCcddEEFF
- AaBbCcDDEeFf

(NSEB 2015-16)

6. The figures depict representative illustrations of three categories of animals with segmented bodies.



A : Tapeworm B : Nereid worm C : Centipede

Which of these animal/s show metameric segmentation?

- (a) B only (b) A and B
(c) B and C (d) A and C (INBO 2015)
7. There are various types of ATPase pumps found in different types of cells. Of these, F-type ATPases, also known as ATP synthases, drive ATP synthesis. They are found in all of the following except
(a) inner membrane of mitochondria
(b) thylakoid membrane of chloroplasts
(c) plasma membrane of prokaryotes
(d) plasma membrane of fungi. (INBO 2014)
8. Ectomycorrhiza – a symbiotic association between plant roots and fungi is important in obtaining phosphorus and other nutrients for the plant. Which of the following points characterise the relationship?
1. Penetration of host cell by fungal hyphae
2. Creation of a vast network of hyphae to absorb nutrients
3. Change in soil pH
4. Movement of organic carbon to fungi
(a) 1, 2, 3 and 4 (b) Only 1, 2 and 3
(c) Only 2 and 3 (d) Only 2, 3 and 4 (INBO 2014)
9. Denitrification is a process carried out by microbes in which nitrates are reduced to molecular nitrogen. This process is predominant in
(a) desert (b) bog
(c) leached soil (d) tilled farm. (NSEB 2013-14)
10. Arrange the following processes sequentially to explain the translocation of food through sieve tubes.
i. Unloading of sugar in sink cells (or cells of root)
ii. Uptake of water from xylem vessels
iii. Transfer of water from sieve cells to xylem vessels
iv. Sugars loaded from leaf cells to sieve cells
(a) ii → iv → iii → i (b) iv → iii → ii → i
(c) iv → ii → i → iii (d) i → iii → iv → ii
(INBO 2013)

SOLUTIONS

1. (b) : Stabilising selection eliminates extremes from the population, reducing variations and hence rates of evolution are typically slow. The plants growing on high-zinc-soil are able to grow due to directional selection as it is a change towards one particular direction, i.e., favours only one plant species and eliminates rest of them.

2. (d) : Fishes consume oxygen irrespective of whether they are at resting or in active state. The solubility of oxygen in water decreases with the rise in temperature, so oxygen consumption rate will also increase in both resting as well as active fishes as depicted in graph (d).

3. (c) : From the given experiment, it can be concluded that both the interacting species are being benefitted (mutualism). This is because while the crabs help in the survival of the corals by preventing the outgrowth of seaweeds (algae), the corals support the survival of the crabs by protecting them from predation. *Oculina arbuscula* can survive in the absence of *Mithrax forceps* (as shown in coral growth graph). So presence of *Mithrax forceps* is not obligatory for survival of coral *Oculina arbuscula*.

4. (c) : Crustaceans belong to the Phylum Arthropoda in which sexes are separate (dioecious) and sexual dimorphism is observed in them. In oligochaetes and flatworms, sexes are separate, while gastropods are hermaphrodites, some have separate sexes.

5. (b) : The number of gametes formed by an individual can be calculated by applying the formula of 2^n where n is the number of heterozygous gametes present in an individual. In the given question, the individual in option (b) will produce 16 gametes as the number of heterozygous gametes present is 4. Therefore, by applying the formula of 2^n , we can conclude that $2^4 = 16$, i.e., 16 gametes will be produced.

6. (c) : Tapeworm belongs to Phylum Platyhelminthes that lack metameric segmentation while nereid worm belongs to Phylum Annelida and centipede belonging to Phylum Arthropoda are characterised by metameric segmentation.

7. (d) : F-type ATPases are one of the transmembrane ATPases found in mitochondria, chloroplast and bacterial plasma membranes where they are prime producers of ATP. In plasma membrane of fungi, P-type ATPases are found.

8. (d) : In ectomycorrhiza, the fungal hyphae lies in intercellular spaces of the cortex and does not penetrate the cortical cells. The root cells secrete sugars and other food ingredients into the intercellular spaces for feeding the fungal hyphae.

9. (b) : Bog is a wet, muddy and spongy ground that is rich in dead and decaying plant material. Hence, it is a perfect habitat for microbes due to high moisture content, anaerobic conditions and organic matter.

10. (c)



BIOLOGY TODAY 2017

AT A GLANCE

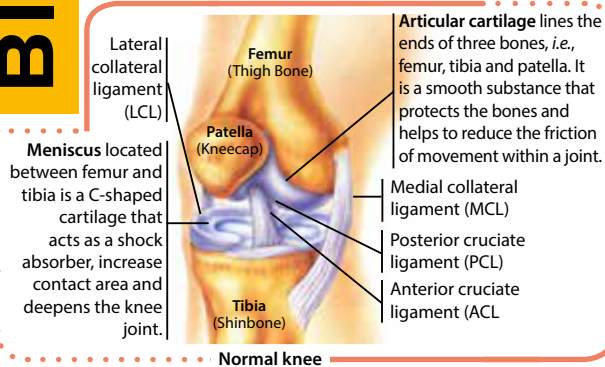
MONTHS	HIGH YIELD FACTS		PMT / NEET ESSENTIAL	PMT / NEET FOUNDATION	CONCEPT MAP
	BOTANY	ZOOLOGY			
JAN	Cellular Respiration	Structural Organisation in Animals	Human Genetic Disorders	Genetics and Evolution	Simple Permanent Tissues
FEB	Photosynthesis in Higher Plants	Biodiversity and Conservation	Human Endocrine System	Biology in Human Welfare	Malaria : Cause, Symptoms and Treatment
MARCH	Transport in Plants	Environmental Pollution	Human Excretory System	Biotechnology	The Ear
APRIL	Cell : The Unit of Life I	Reproductive Health	Physiology of Digestion	Diversity in the Living World	Frog
MAY	Cell : The Unit of Life II	Human Health and Diseases	Human Female Reproductive System	Structural Organisation in Plants and Animals	Synapse
JUNE	Biotechnology : Principles and Processes	Locomotion and Movement	Plant Tissues and Tissue Systems	Cell: Structure and Functions	DNA Replication
JULY	Biomolecules - I	Microbes in Human Welfare	Double Fertilisation in Angiosperms	Plant Physiology	Human Heart : Structure and Function
AUG	Biomolecules - II	Neural Control and Coordination	Applications of Biotechnology	Human Physiology	Transcription
SEPT	Ecosystem	Breathing and Exchange of Gases	Kingdom Protista	.....	Human Digestive System
OCT	Plant Growth and Development	Animal Kingdom : Non-Chordates	Conception and Pregnancy in Humans	Human Physiology	Translation
NOV	Principles of Inheritance and Variation	Animal Kingdom : Chordates	Cell Cycle and Cell Division	Reproduction	Five Kingdom Classification
DEC	Plant Kingdom	Evolution - I	Secondary Growth in Plants	.....	Asexual Reproduction

	NCERT XTRACT	SOLVED PAPER (2017)	PRACTICE PAPER	INTERACTIVE SESSION	SPECIAL FEATURES
JAN	Molecular Basis of Inheritance	.....	CBSE Board (Unit V), MPP-7 (XI & XII)	Unscramble Me, Crossword, Spellathon	Biology Olympiad Problems, Biogram, Bioreporter, Scientist Info
FEB	Evolution	.....	CBSE Board 2017, MPP-8 (XI & XII)	Unscramble Me, Crossword, Spellathon	Biogram, Bioreporter, Scientist Info
MARCH	.....	.....	CBSE Board 2017, MPP (XI & XII), NEET	Unscramble Me, Crossword, Spellathon	Biogram, Bioreporter, Scientist Info
APRIL	.....	.....	NEET, AIIMS, CBSE Board 2017, MPP (XI & XII)	Unscramble Me, Crossword, Spellathon	Biogram, Biology Olympiad Problems, Scientist Info
MAY	.....	CBSE Board	NEET, AIIMS, MPP-1 (XI & XII)	Unscramble Me, Spellathon	Scientist Info
JUNE	Molecular Basis of Inheritance	NEET-2017	MPP - 2 (XI & XII)	Unscramble Me, Spellathon, Crossword	Biogram, Bioreporter, Scientist Info
JULY	Strategies For Enhancement in Food Production	.....	MPP - 3 (XI & XII)	Unscramble Me, Spellathon, Crossword	Biogram, Biology Olympiad Problems
AUG	Principles of Inheritance and Variation	.....	MPP - 4 (XI & XII)	Unscramble Me, Spellathon, Crossword	Success Story, Biogram, Biology Olympiad Problems, Scientist Info
SEPT	Human Health and Diseases	.....	MPP - 5 (XI & XII), CBSE Board (Unit-I)	Unscramble Me, Spellathon, Crossword	Biology Olympiad Problems, Bioreporter, Biogram, Scientist Info, Success Story
OCT	.....	.....	MPP-6 (XI & XII), CBSE Board (Unit-II)	Unscramble Me, Spellathon, Crossword	Biogram, Biology Olympiad Problems, PMT Practice Paper (Class XII)
NOV	.....	.....	MPP-7 (XI & XII), CBSE Board (Unit-III)	Unscramble Me, Spellathon, Crossword	Biology Olympiad Problems, Noble Prize 2017
DEC	Morphology of Flowering Plants	.....	MPP-8 (XI & XII), CBSE Board (Unit-IV)	Unscramble Me, Spellathon, Crossword	Biogram, Biology Olympiad Problems, PMT Practice Paper (Class XII)

Total Knee Replacement Surgery

Knee replacement is a surgical procedure wherein the diseased knee joint is replaced with artificial material. It is also called arthroplasty or resurfacing as only the surface of bones are replaced. The knee replacement surgery is considered only for those patients whose knee joints have been damaged by either progressive arthritis or other rare destructive diseases of the joint. There are different types of knee replacement surgery-total knee replacement, partial knee replacement, kneecap replacement, revision knee replacement, etc. Out of these, the most common form is total knee replacement surgery in which the surfaces of thigh bone and shin bone that connect the knee are replaced. Patella may or may not be resurfaced depending upon the requirement.

Normal Knee vs Diseased Knee Due to Osteoarthritis

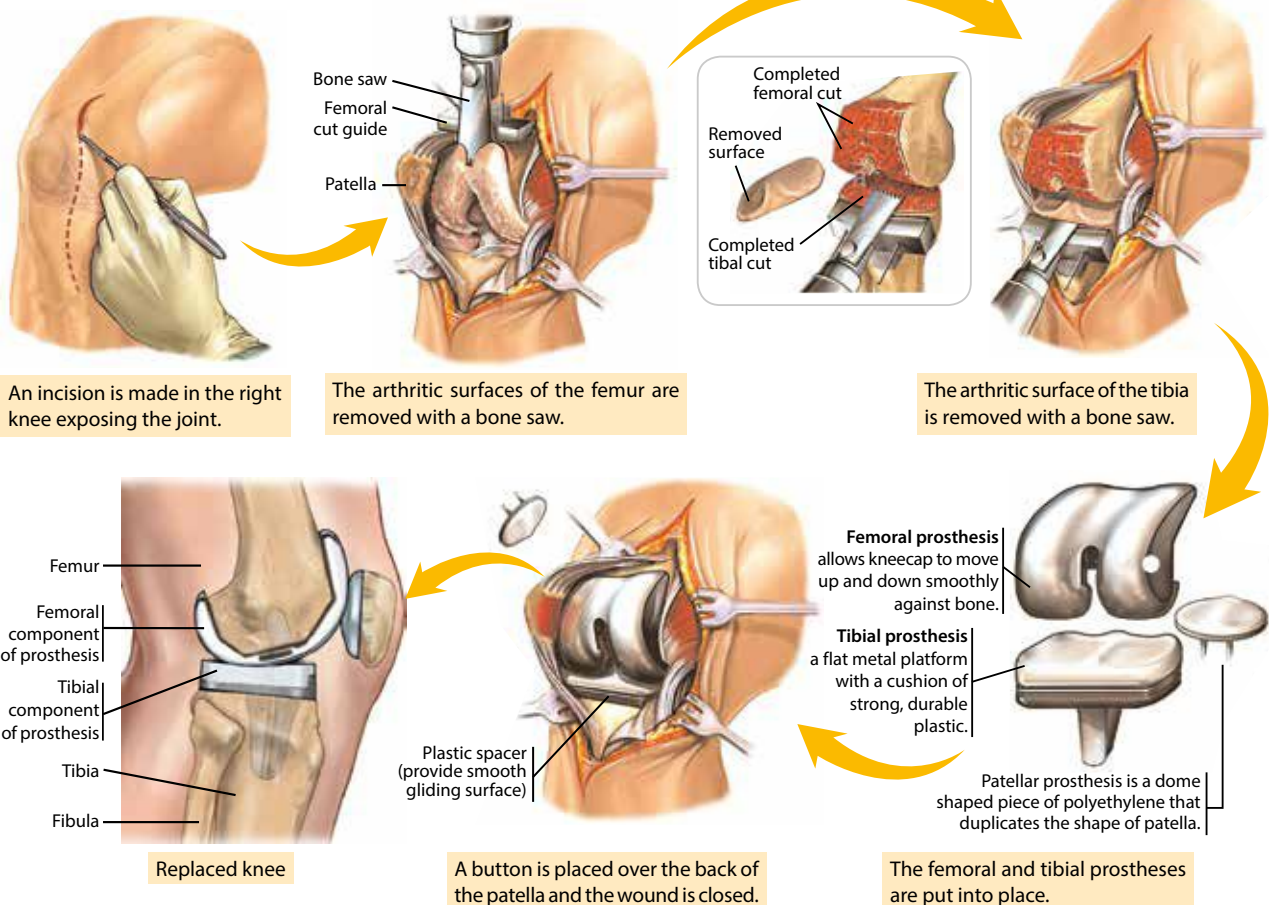


Knee is the largest joint (hinge joint) in the body and is required to perform most of the day to day activities. It is formed from lower end of thigh bone (femur), the upper end of shin bone (tibia) and kneecap (patella).

Normally, all the components of knee work in harmony but a disease such as osteoarthritis can disrupt it, resulting in chronic knee pain and disability. The progressively increasing pain and stiffness lead to total knee replacement.



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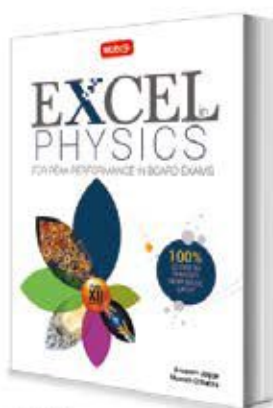


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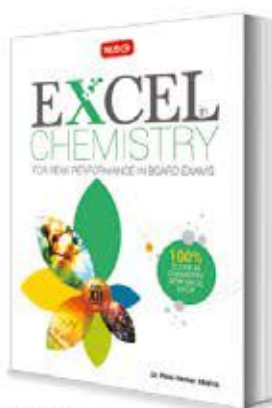
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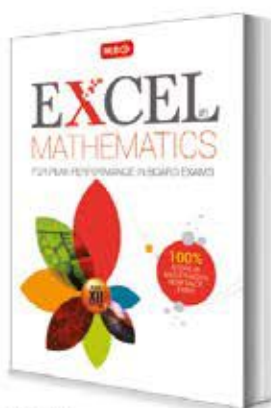
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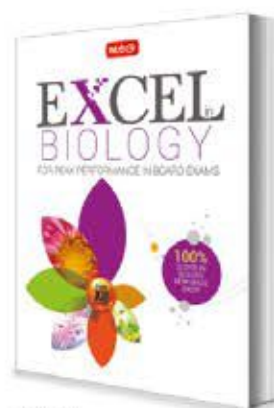
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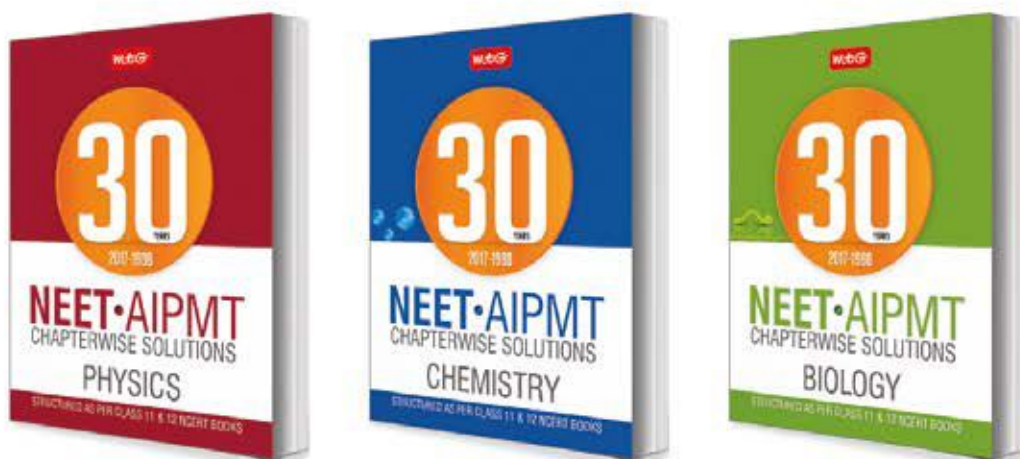
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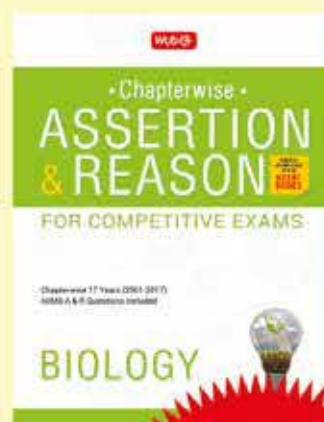
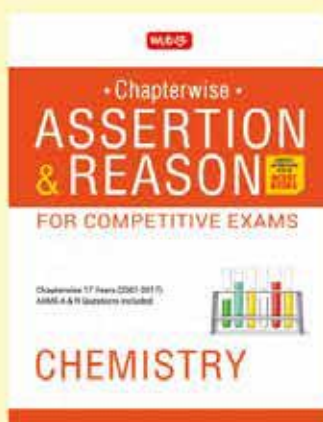
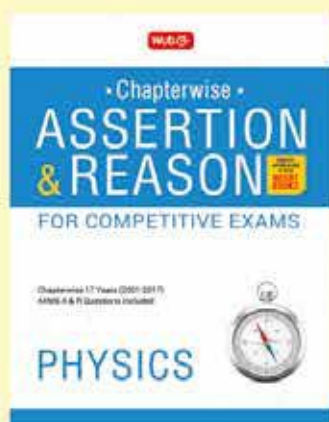
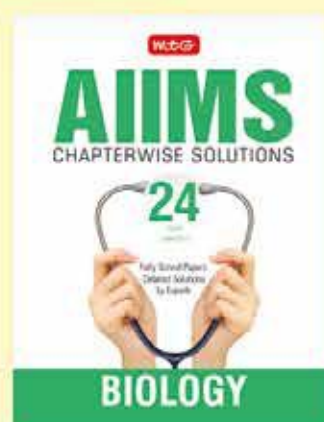
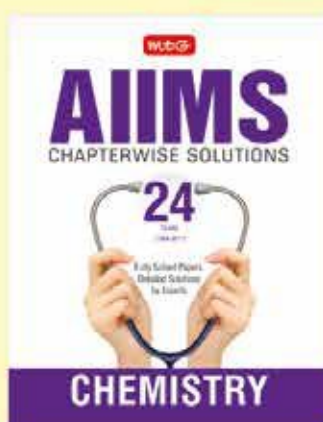
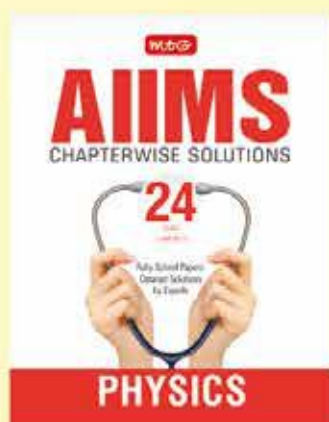
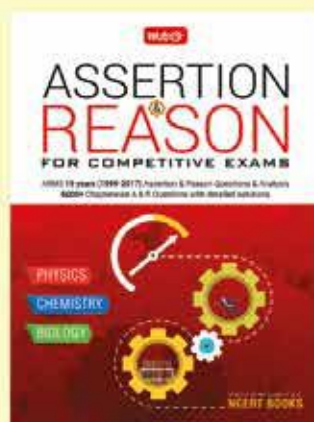
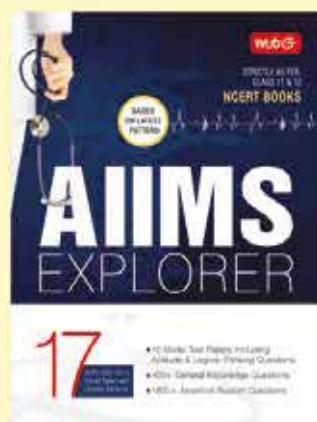


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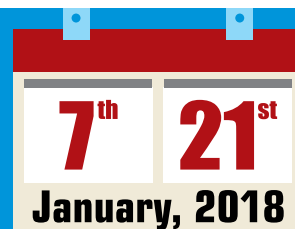
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