Solution

BIOLOGY

Class 12 - Biology

Section A

1. Select and write the correct answer:

(i) **(a)** Ethological
Explanation: {
Ethological

(ii) **(c)** Herbicide
Explanation: {
Herbicide

(iii) **(d)** 32
Explanation: {
If reaction is started using one dsDNA molecule, one cycle of PCR produces 2 copies of dsDNA. Therefore, number of dsDNA molecules produced = 2^n, where $n =$ number of PCR cycles.
$2^n = 2^5 = 32$

(iv) **(c)** Angina pectoris
Explanation: {
Angina pectoris

(v) **(c)** cornea
Explanation: {
cornea

(vi) **(c)** dead organic matter
Explanation: {
dead organic matter

(vii) **(a)** hypertonic
Explanation: {
hypertonic

(viii) **(a)** two organisms are benefitted from each other
Explanation: {
two organisms are benefitted from each other

(ix) **(c)** Nagpuri, Murrah and Surati
Explanation: {
Nagpuri, Murrah and Surati

(x) **(d)** Ty2la
Explanation: {
Ty2la

2. Answer the following:

(i) i. Autosomal dominant traits: Widow's peak and Huntington's disease
ii. Autosomal recessive traits: Phenylketonuria (PKU), Cystic fibrosis and Sickle cell anaemia.

(ii) Unconditional reflexes are sneezing, coughing, yawning, hiccupping.

(iii) W: Suspensor
X: Plumule
Y: Radicle
Z: Cotyledons

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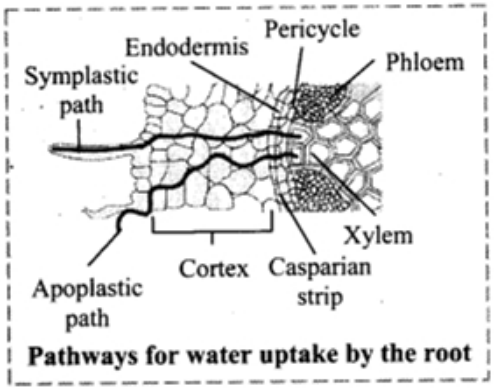
(iv) Following is the T.S of root showing water movement:



Pathways for water uptake by the root

(v) Eutrophication occurs due to overgrowth of algae at instance of high phosphorus dissolved in water.

(vi) Tryptophan is the primary precursor of IAA in plants.

(vii) The function of zona pellucida is to prevent the implantation of the embryo at an abnormal site. It does not expose the sticky and phagocytic trophoblast cells till it reaches the implantation site i.e. within the uterus, after which the zona pellucida ruptures.

(viii) Following is the correct sequence of the steps performed during DNA fingerprinting technique:

ii. Isolation of DNA

iv. Restriction digestion

i. Gel electrophoresis

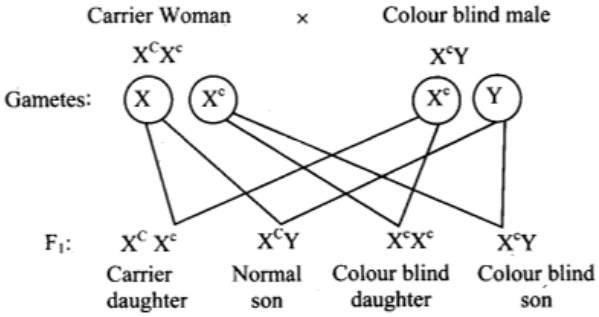
iii. Southern blotting

Section B

3. Answer the following:

(i) The character which is not expressed in F_1 generation is called recessive character.

(ii) If a carrier woman marries a colorblind man, following would be possible phenotypes of their progeny:



4. i. **Gene flow:** Gene flow is movement of genes into or out of a population.

ii. **Chromosomal aberrations:** The structural and morphological change in chromosome due to rearrangement is called chromosomal aberrations.

5. A. Lymphocyte

B. Eosinophil

C. Monocyte

D. Neutrophil

6. i. This technology provides the chances of successful production of hybrids.

ii. In this method, cow is administered with **Follicle Stimulating Hormone** (FSH) like hormone, to induce follicular maturation and then the super ovulation is brought about.

iii. In each cycle, 6 to 8 eggs mature simultaneously.

iv. The cow is either mated with an elite bull or artificially inseminated.

v. The blastocysts at 8 to 32 cell stage are recovered non-surgically and transferred to surrogate mothers.

vi. This technology is successfully used in cattle, sheep, rabbits, buffaloes, etc.

vii. High milk yielding breeds of female and high quality meat yielding bulls have been found to be successful, to increase herd size in a short period.

7. **Chromosomal aberrations shown in the given figures are:**

A. Deletion

B. Duplication

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C. Inversion

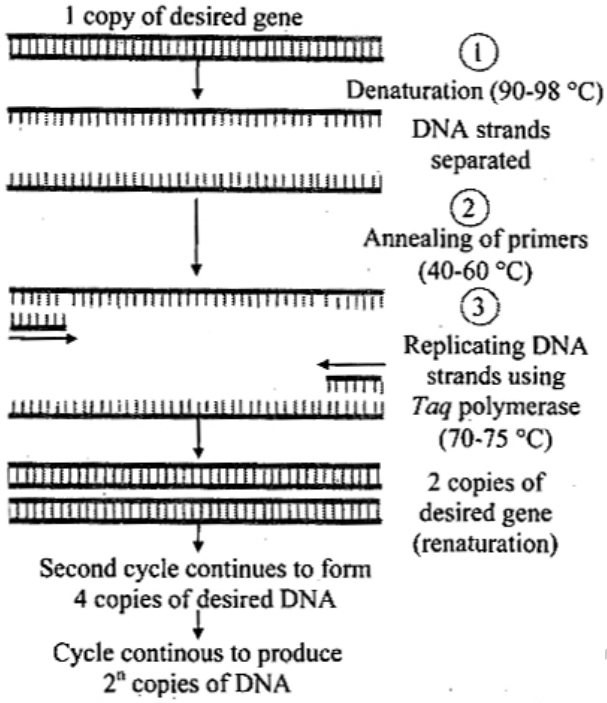
D. Translocation

8. Answer the following:

(i) In situ conservation includes hot spot method.

(ii) Carbon dioxide (CO_2) is mainly responsible for global warming.

9.



DNA replication through polymerase chain reaction (PCR)

10. i. The low temperature treatment or chilling treatment of germinating seeds or seedlings to promote early flowering in plants is called vernalization. The site of vernalization is believed to be shoot apical meristem.

ii. Advantages of vernalization:

a. Early flowering can be induced in crop plants by shortening of the juvenile phase.

b. Crops can be cultivated in regions where they do not grow naturally.

11. i. Conservation of' species outside their natural habitat is called ex situ conservation.

ii. Wildlife safari parks, zoological parks and botanical gardens serve this purpose.

12. i. **Follicle Stimulating Hormone (FSH):**
In males, it stimulates the development of seminiferous tubules.
In **females**, it stimulates the growth of ovarian follicles.
[**Note:** FSH acts on Sertoli cells to stimulate spermatogenesis in testis]

ii. **Luteinizing hormone (LH):** LH induces the ruptured follicles to develop into corpus luteum and for production of progesterone. FSH and LH are responsible for stimulation of ovaries to produce oestrogen.

iii. **ICSH:** In males, it stimulates the testes to produce the androgen called testosterone. Testosterone is responsible for development of secondary sexual characters.
[**Note:** Luteinizing hormone (LH) is also known as Interstitial cell stimulating hormone (ICSH)] [Any two]

13. i. 'A' is symplast pathway. When water moves from one living cell to other living cell through plasmodesmata, then it is called symplast pathway.

ii. 'B' is apoplast pathway. When water passes across the root through the cell wall and the intercellular spaces of cortical cells of root, it is called as apoplast pathway.

14. Each complete turn of a double helical DNA consists of 10 nucleotide base pairs with the length of complete turn being 34 $\mathring{A}$

Therefore the length of eukaryotic DNA fragments with 10 pairs of nucleotides will be 34 $\mathring{A}$

Section C

15. **Following are the characteristics of Neanderthal man:**

i. They were advance prehistoric man.

ii. Their fossils were collected from Neanderthal valley, Germany.

iii. They existed in late Pleistocene epoch about 100000 to 400000 years ago.

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iv. Cranial capacity of Neanderthal Man was 1400 cc.
v. These were short and had heavy built.
vi. They had short prominent brow ridges, the skull bones were thick, forehead was low and slanting, the jaw was deeper than that of modern man with no chin. They had outwardly curved thigh bones
vii. They were quite intelligent to use and construct flint tools.
viii. They buried their dead bodies.

16. Answer the following:

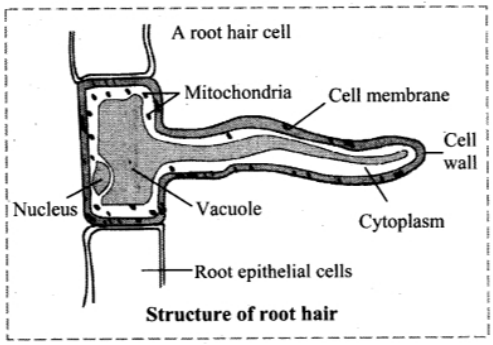
(i) Polyembryony is the development of more than one embryo, inside the seed, which consequently results in the emergence of multiple seedlings.

(ii) Adaptations in chiropterophilous flowers:

i. Flowers are dull coloured with strong fragrance.
ii. They secrete abundant nectar.
iii. Flowers produce large amount of edible pollen grains.
iv. Chiropterophily is shown by plants like Anthocephalus (kadamb tree), Adansonia (Baobab tree), Kigelia (Sausage tree).

17. i. Water has high specific heat, high heat of vaporization and high heat of fusion. Due to this, it acts as thermal buffer.

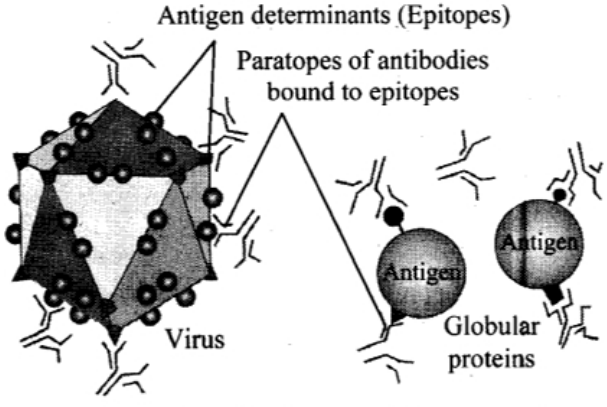
ii.



Structure of root hair

a. Root hair is cytoplasmic extension (prolongation) of epiblema cell.
b. Each root hair may be approximately 1 to 10 mm long and tube like structure.
c. It is colourless, unbranched, short-lived (ephemeral) and very delicate.
d. It has a large central vacuole surrounded by thin film of cytoplasm, plasma membrane and thin cell wall, which is two layered.
e. Outer layer is composed of pectin and inner layer is made up of cellulose.
f. Cell wall of a root hair is freely permeable but plasma membrane is selectively permeable.

18. i. Each antibody is specific for a particular antigen.
ii. Combining sites of antigen, called antigenic determinants (epitopes) react with the corresponding antigen binding sites of antibodies called paratopes.
iii. The antigen binding sites (paratopes) are located on the variable regions of the antibody.
iv. Small variations in the variable regions make each antibody highly specific for a particular antigen.
v. The variable region enables the antibody to recognize the specific antigen and bind to specific antigen in a lock and key manner forming an antigen-antibody complex.



Formation of antigen- antibody complex

19. Answer the following:

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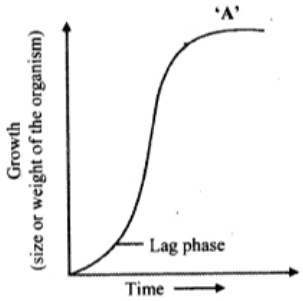
(i) Commensalism is the interaction in which one species benefits and the other is neither harmed nor benefited.

(ii) 

'A' is the stationary phase.

20. i. Lac insect is a native of India and our share is 85% of total lac produced in the world.
ii. Products of lac play a vital role in the economy of the farmers.
iii. Lac is used in bangles, toys, woodwork, inks, mirrors, etc.

21. i. **Differentiation**

a. It is maturation of cells derived from apical meristem of root and shoot.
b. Permanent change in structure and function of cells leading to maturation is called differentiation.
c. During cell differentiation, cell undergoes few to major anatomical and physiological changes.
d. For e.g., Parenchyma in hydrophytes develops large schizogenous interspaces for mechanical support, buoyancy and aeration.
e. Cells lose the capacity to divide and redivide and mature.
[Any two points]

ii. **Re-differentiation**

a. The cells produced by dedifferentiation once again lose the capacity to divide and mature to perform specific function. This is called redifferentiation.
b. For e.g., secondary xylem and secondary phloem are formed from dedifferentiated cambium present in the vascular bundle.

22. i. **Neo-Mendelism:**

a. Different patterns of inheritance or gene interactions were discovered based on Mendelian ratios.
b. These interactions can be explained by modifying Mendel's laws thus; this is called Post Mendelian genetics or Neo-Mendelian genetics.

ii. **Quantitative inheritance:**

Quantitative inheritance is a type of inheritance controlled by one or more genes in which the dominant alleles have cumulative (collective) effect with each dominant allele expressing a part or unit of the trait. The complete trait is expressed only when all the dominant alleles are present.

The genes involved in quantitative inheritance are called polygenes. Quantitative inheritance is, therefore, also called polygenic inheritance.

Quantitative types of traits are also called continuous traits since they usually are displayed on a continuous spectrum, or range, of variation. The inheritance of such traits is known as quantitative inheritance.

23.

No.	Type	Location	Function
a.	Mechano-receptors	Skin	Sensitive to mechanical stimuli like touch, pain, pressure, deep pressure, etc.
b.	Statoacoustic receptors	Internal ear-semicircular canals	Receptors for maintaining balance and equilibrium
c.	Baroreceptors (These are also considered as mechanorecep tors, receiving signals from internal organ)	Present in walls of atria, venae cavae, aortic arch, carotid sinus	Sensitive to changes in blood pressure so as to restore homeostasis through vasodilation or vasoconstriction

24. Answer the following:

(i) Cloverleaf structure of tRNA possesses an anticodon loop that has bases complementary to the codon. It is called anticodon.

(ii)

Sr.	Heterochromatin	Euchromatin

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No.		
i.	It stains strongly and appears dark.	It stains light.
ii.	Heterochromatin is genetically and transcriptionally inactive	Euchromatin is genetically and transcriptionally very much active and fast replicating.

25. i. **Lymphocytes:**

a. Lymphocytes are the smallest of all WBCs. They have a large spherical nucleus.

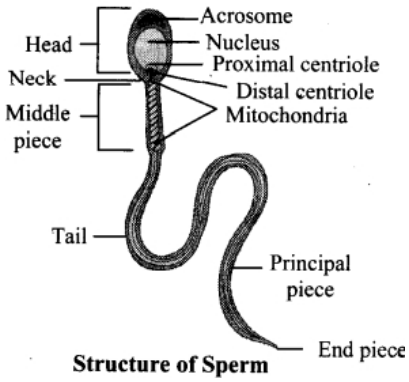
b. .They constitute about 25-30% of total WBCs.

c. Depending upon function, two types of lymphocytes are present as Bvlymphocytes and T-Iymphocytes. B-lymphocytes mature in bone marrow and are responsible for antibody production/humoral immunity. Tlymphocytes mature in thymus and are responsible for cell-mediated immunity. Helper T-cells, killer T-cell, memory Tcells and suppressor T-cells are four main subtypes of T lymphocytes.

ii. Temporary increase in number of WBCs is called as leucocytosis. Uncontrolled increase in number of WBCs is a type of blood cancer called leukemia.

iii. Functions of neutrophils: They perform amoeboid movements. They destroy pathogens by the process of phagocytosis.

26.



Structure of Sperm

For structure of human sperm:

Human sperm:

Sperm is the male gamete. It is a motile, microscopic and elongated cell.

The sperm is divisible into three parts: Head, middle piece and tail.

a. **Head:** The sperm head is oval in shape and contains haploid nucleus.
Above the nucleus, there is a cap like structure called acrosome which is formed from the Golgi body. Acrosome contains hydrolytic enzymes like hyaluronidase and proteolytic enzymes like zona lysins and corona penetrating enzymes.

b. **Neck:** It is a very short region having two centrioles i.e. proximal centriole and distal centriole.

c. **Middle piece:** It has an axial filament surrounded by 10-14 spiral turns of mitochondria (Nebenkern). It produces energy necessary for the movement of sperm.

d. **Tail:** It is a long, slender and tapering part containing cytoplasm and fine thread i.e. axial filament.
The axial filament arises from the distal centriole and travels throughout the length of tail. It is partly surrounded by plasma membrane (main piece).
The part without plasma membrane is called end piece.

Section D

27. Answer the following:

(i) Other name for Dentist's nerve: Trigeminal nerve.

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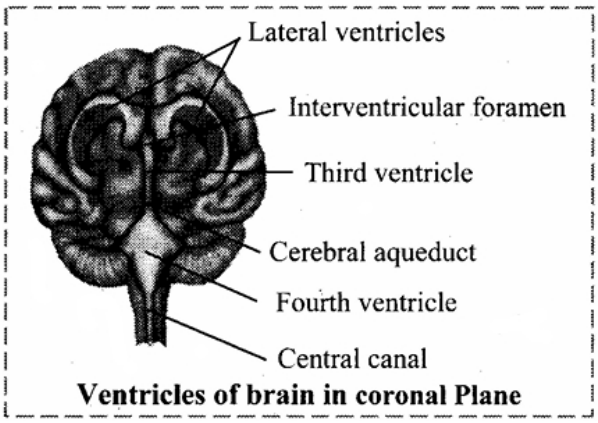
(ii) i. Ventricles of brain in coronal plane:

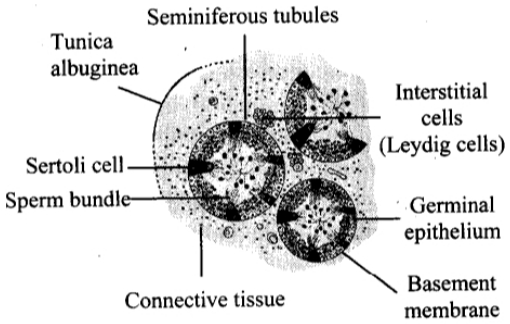


Ventricles of brain in coronal Plane

ii. Cavity which is continuation of IVth ventricle: Cavity of medulla.

(iii) Cretinism

28.



T. S. of Testis

Histology of Testis:

i. Externally, testis is covered by three layers. These are:
   a. **Tunica vaginalis:** It is the outermost incomplete peritoneal covering made up of connective tissue and epithelium.
   b. **Tunica albuginea:** It is the middle layer formed by collagenous connective tissue.
   c. **Tunica vasculosa/vascularis:** It is the innermost layers. It is a thin and membranous layer.

ii. Each testis is divided into about 200-300 testicular lobules by fibres from tunica albuginea. Each lobule has 1 to 4 highly coiled seminiferous tubules.

iii. Each seminiferous tubule is internally lined by a single layer of cuboidal germinal epithelial cells (spermatogonia) and few large pyramidal cells called Sertoli or sustentacular cells.

iv. The germinal epithelial cells undergo gametogenesis to form spermatozoa.

v. Sertoli cells provide nutrition to the developing sperms.

vi. Various stages of spermatogenesis can be seen in the seminiferous tubules. The innermost spermatogonial cell (2n), primary spermatocyte $(2n)$, secondary spermatocyte (n), spermatids (n) and sperms (n).

vii. Between seminiferous tubules, few groups of interstitial cells (Cells of Leydig) are present.

viii. After puberty, interstitial cells produce a type of androgen i.e. testosterone.

The process of spermatogenesis involves three phases:

i. **Multiplication phase:** The primordial germ cells (2n) of the seminiferous tubules undergo repeated mitotic divisions to produce large number of spermatogonia (2n).
   Each spermatogonium is diploid and with 46 chromosomes.

ii. **Growth phase:** Some of the spermatogonia stop dividing and grow in size to develop into primary spermatocytes (2n) due to accumulation of food.

iii. **Maturation phase:** It involves meiotic or reduction division.
   The spermatocyte undergoes the first phase of meiotic division (meiosis I) leading to formation of two haploid cells called secondary spermatocytes (n) having 23 chromosomes each.
   The secondary spermatocyte undergoes second phase of meiotic division (meiosis II) to produce four haploid spermatids.
   The spermatid is non-motile and non-functional. It gets transformed into a functional spermatozoa by the process called spermiogenesis.
   Changes during spermiogenesis:
   During this process of change, the spermatids remain held to each other and to the Sertoli cells by cytoplasmic bridges.

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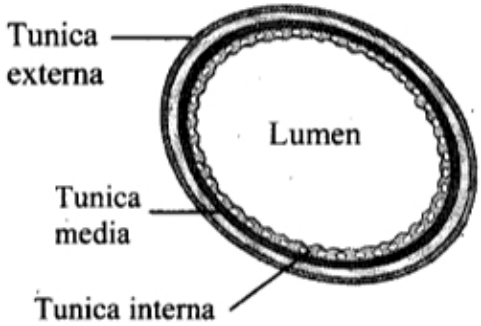
The sperm heads remain attached to the Sertoli cells with their tails hanging in the lumen of seminiferous tubule. During spermiogenesis, the length of the spermatid increases. Centrioles are rearranged as primary and distal centrioles. Mitochondria become spirally coiled and acrosome is formed from Golgi complex.

29. Answer the following:

(i)



T. S. of Vein

(ii) In human pharynx, there is a set of lymphoid organs called **tonsils**.

(iii) T wave represents ventricular diastole.

30. i. **Mechanism of PCR:**

At the start of PCR, all the requirements are mixed together in 'eppendorf tube' and the following operations are performed sequentially:

Step i: Denaturation

The reaction mixture is heated to a temperature $(90-98^{\circ}C)$ to separate two strands of desired DNA. This is called denaturation.

Step ii: Annealing

The mixture is allowed to cool $(40-60^{\circ}C)$ that permits pairing of the primer to the complementary sequences in DNA. This step is called annealing.

Step iii: Primer extension / Polymerization

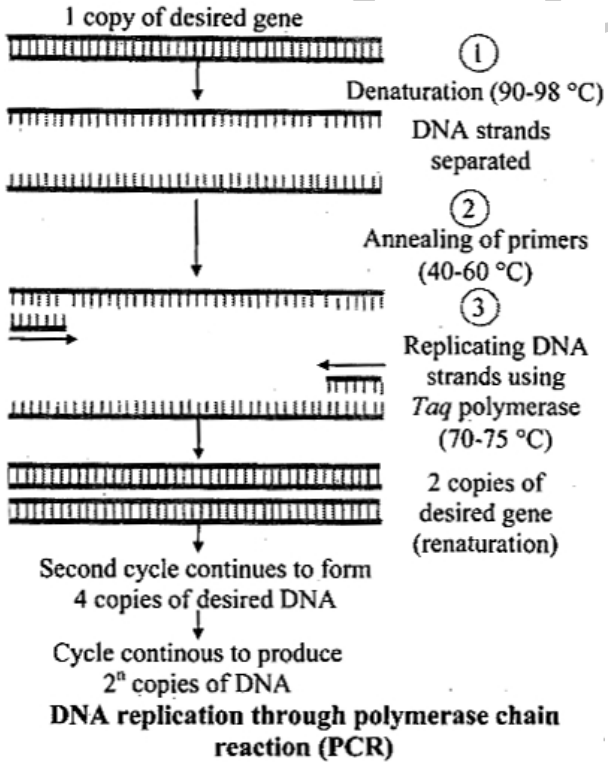
The temperature $(70-75^{\circ}C)$ allows thermostable Taq DNA polymerase to use single-stranded DNA as template and adds nucleotides. This is called primer extension. It takes around two minutes duration.

a. One cycle takes around 3 to 4 minutes.

b. To begin second cycle, DNA is again heated to convert double stranded DNA into single strands.

c. In an automatic thermal cycler, the above three steps are automatically repeated $20-30$ times. Thus, at the end of ' n ' cycles 2^n copies of DNA segments are produced.

ii.



DNA replication through polymerase chain reaction (PCR)

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31. **Development of dicot embryo:**

i. The zygote divides to form two-celled proembryo.
ii. The larger cell towards the micropyle is called basal or suspensor initial cell and smaller cell towards chalaza is called terminal or embryonal initial cell.
iii. The suspensor cell divides transversely in one plane to produce filamentous suspensor of 6 10 cells.
iv. The first cell of the suspensor towards the micropylar end becomes swollen and functions as a haustorium.
v. The lowermost cell of suspensor is known as hypophysis.
vi. The suspensor helps in pushing the embryo in the endosperm.
vii. The embryonal initial undergoes three successive mitotic divisions to form octant.
viii. The planes of divisions are at right angles to each other.
ix. The lower tier of four cells of octant give rise to hypocotyl and radicle whereas four cells of upper tier form the plumule and the one or two cotyledons.
x. The hypophysis by further division gives rise to the part of radicle and root cap.
xi. Subsequently, the cells in the upper tier of octant divide in several planes so as to become heart shaped which then forms two lateral cotyledons and a terminal plumule.
xii. Further enlargement of hypocotyl and cotyledons result in a curvature of embryo and it appears horse-shoe shaped.

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