

Solution

BIOLOGY

Class 12 - Biology

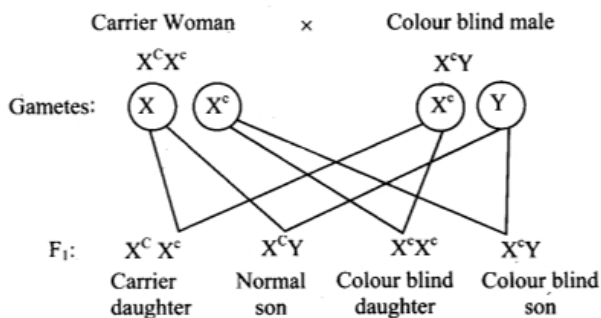
Section A

1. Select and write the correct answer:

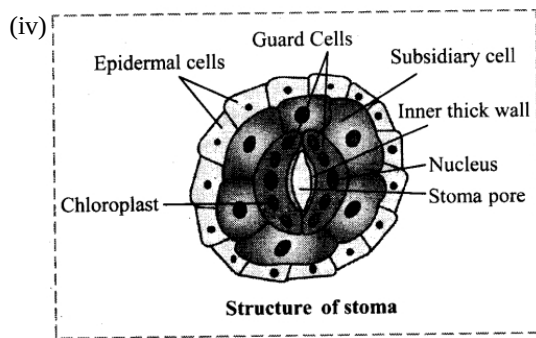
- (i) (c) Theory of organic evolution
Explanation: {
Theory of organic evolution
- (ii) (c) Gibberellic acid
Explanation: {
Gibberellic acid
- (iii) (c) endonucleases
Explanation: {
endonucleases
- (iv) (d) modified cardiac muscles
Explanation: {
modified cardiac muscles
- (v) (a) Adrenal gland
Explanation: {
Adrenal gland
- (vi) (d) producers
Explanation: {
producers
- (vii) (b) capillary
Explanation: {
capillary
- (viii) (c) Asian koel and common Indian crow
Explanation: {
Asian koel and common Indian crow
- (ix) (a) *Streptomyces venezuelae*
Explanation: {
Streptomyces venezuelae
- (x) (a) Rh^{-ve}
Explanation: {
 Rh^{-ve}

2. Answer the following:

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



- (ii) Unconditional reflexes are sneezing, coughing, yawning, hiccupping.
- (iii) The megaspore mother cell is a diploid cell, and the endosperm is a triploid tissue. If the megaspore mother cell has 26 chromosomes, the endosperm of the same plant will have 39 chromosomes.



- (v) Decomposers carry out decomposition i.e. breakdown of complex organic matter into inorganic substances like carbon dioxide, water and nutrients.
- (vi) Auxin is used for early rooting in propagation by cutting.
- (vii) Cells of Rauber are the trophoblast cells which are in contact with embryonal knob during blastulation.
- (viii) RNA primer is required to initiate the synthesis of new complementary strand during DNA replication.

Section B

3. Answer the following:

- (i) **Definition:** The cross between F₁ hybrid and its homozygous recessive parent is called as test cross.

Significance of test cross:

- It helps to determine whether individuals exhibiting dominant character are genotypically homozygous or heterozygous.
- It has wide application in plant breeding experiments.
- In rapid crop improvement programmes, test cross is used to introduce useful recessive trait in the hybrids.

- (ii) The mutated gene for β -Thalassemia is located on chromosome 11.

4. a. The study of ancient life with the help of fossils is called palaeontology.

b. The significance of palaeontology:

- It is useful in reconstruction of phylogeny.
- It helps in studying various forms and structures of extinct animals.
- It provides record of missing link between two groups of organisms.
- It helps in the study of habits of extinct organisms.
- Connecting links can be identified by palaeontology which can provide evidence for organic evolution.

5. i. Breakdown of alveoli, shortness of breath - Emphysema

ii. Inflammation of the sinuses, shortness of breath - Sinusitis

iii. Inflammation of larynx, vocal cord, sore throat, hoarseness of voice, mucous build up and cough - Laryngitis

iv. Inflammation of fibrosis, lung damage - Silicosis and asbestosis

6. i. Gibberellin is a group of growth hormones mainly produced by higher plants and fungi to promote growth by stem elongation.

ii. Applications of gibberellins:

a. They are used to induce parthenocarpy in apple, pear, etc.

b. They are used in breaking the dormancy of seed and also in inducing flowering in Long Day Plants (LDP).

c. They are also used to enlarge the size of grape fruits.

7. Interspecific hybridization involves breeding of animals of two different but related species within the same genus.

Mule is progeny of a female horse (*Equus ferus caballus*) and a male donkey (*Equus africanus asinus*).

Intergeneric hybridization involves crosses between species from distinct genus.

In this case Mule is a interspecific hybrid which is sterile.

8. Answer the following:

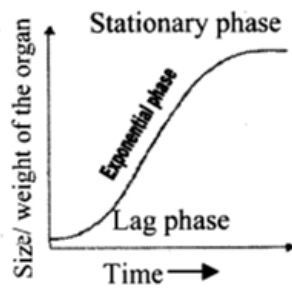
- (i) Pollution can be defined as 'an undesirable change in physical, chemical or biological characteristics of our air, water and land that may or will harmfully affect human life and the environment.

- (ii) Deforestation is conversion of forest areas into non-forest areas.

9. i. **Biopatent-** A biopatent is a patent granted by the government to the inventor for biological entities, processes and products.

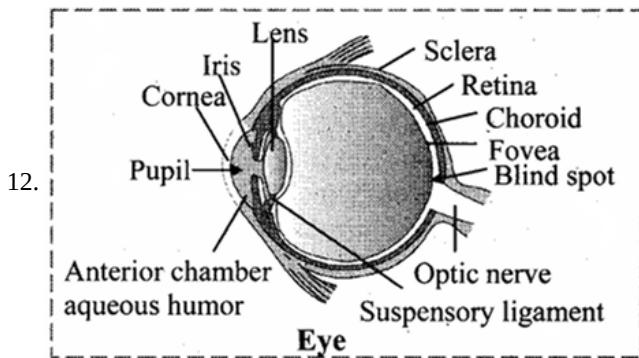
ii. **Biopiracy** is defined as 'theft of various natural products and then selling them by getting patent without giving any benefits or compensation back to the host country'.

10. i. The curve obtained when a graph of growth rate against time is plotted for three phases of growth, is called as a sigmoid curve.



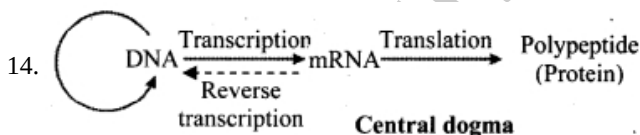
Sigmoid Growth curve

- ii. Growth rate differs with three distinct phases of growth.
 - iii. In Lag phase, growth rate is slow.
 - iv. In Exponential (Log) phase, growth rate is faster and reaches its maximum.
 - v. In Stationary phase, growth rate gradually slows down.
11. i. Automobiles are the major source for atmospheric (air) pollution.
- ii. Waste gas released from jet planes, chemical industries are other major causes of air pollution.
- iii. Household activities, agriculture, wildfires and construction activities also contribute to air pollution.



13. Factors affecting water absorption:

- i. Presence of capillary water is essential for water absorption.
- ii. Rate of water absorption is maximum at soil temperature between 20° to $30^{\circ}C$.
- iii. High concentration of solutes in soil water reduces the rate of water absorption.
- iv. Poorly aerated soil shows poor absorption rate.
- v. Increased transpiration accelerates the rate of absorption of water in the irrigated soil.



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.
 - 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:

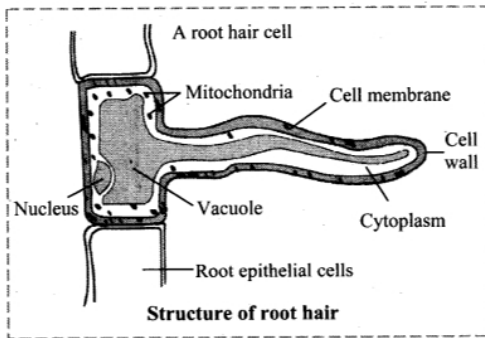
(i) The parts in budding of yeast cell are as follows:

1. Mother cell
2. Bud

(ii) **Significances of double fertilization:**

- i. It is a unique feature of angiosperms.
- ii. It ensures that the parent plant invests a seed with a food store, only if the egg is fertilized.

- iii. The diploid zygote develops into an embryo which consequently develops into a new plant.
 - iv. The triploid PEN develops into nutritive endosperm tissue.
 - v. It restores the diploid condition by fusion of haploid male gamete with haploid female gamete (i.e. through syngamy).
 - vi. It also helps to avoid polyembryony.
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.



- 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. Signs and symptoms of typhoid are as follows:

- i. Prolonged fever as high as 104⁰F.
- ii. General nausea, fatigue and headache.
- iii. Abdominal pain, constipation or diarrhoea.
- iv. Rose-coloured rash on skin.
- v. White coat on tongue, cough.
- vi. Anorexia (loss of appetite).
- vii. If not treated on time, patient may experience breathlessness, irregular heartbeats and haemorrhage.

Mode of transmission typhoid:

- i. It is a food and water borne disease.
- ii. Insects like housefly and cockroaches feeding on faecal matter, may transfer the bacteria to food material.
- iii. Poor hygiene habits and poor sanitation conditions are responsible for the spread of typhoid.

19. Answer the following:

(i) Temperature, water, light and soil are the major abiotic factors that influence the habitat.

(ii) **Mutualism:**

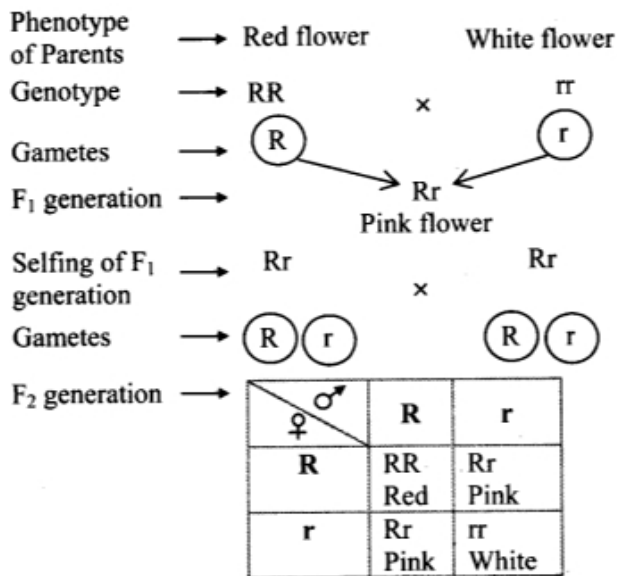
- i. Mutualism is an obligatory and interdependent interaction.
- ii. In this type of interaction, both species - alga and lichen are benefited.
- iii. Lichens represent an intimate, mutualistic relationship between a fungus and photosynthetic algae or cyanobacteria.
- iv. Alga performs photosynthesis, whereas fungus absorbs moisture.

No.	Microbial Product	Microbial source
i.	Vitamin B ₁₂	Pseudomonas denitrificans
ii.	Chloromycetin	Streptomyces venezuelae
iii.	Pectinase	Sclerotinia libertinia

21. i. Auxin is responsible for apical dominance in plants.
- ii. Broad-leaf is a characteristic feature of most dicot weeds.

In order to make farm free from broad-leaf weeds, a farmer must spray the weedicide 2, 4-D (Auxin), as it is a dicot weedicide and is target specific. It does not harm the jowar (monocot) crops.

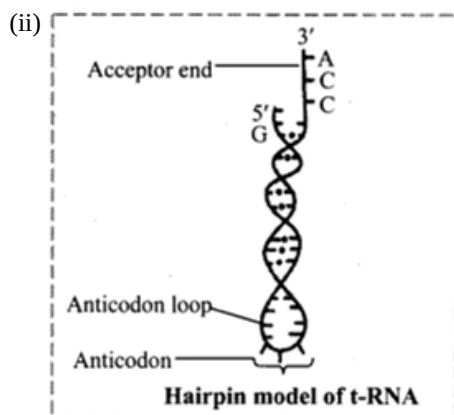
- iii. a. Cytokinins promote cell division. It also promotes cell enlargement.
 b. Cytokinin and auxin ratio and their interactions control morphogenic differentiation.
22. i. Incomplete dominance is a deviation of Mendel's law of dominance.
 In incomplete dominance, both the alleles (genes) of an allelomorphic pair express themselves partially.
- ii. Example of incomplete dominance is flower colour in *Mirabilis jalapa*.
 In *Mirabilis jalapa*, if a red-flowered (RR) plant is crossed with a white-flowered (rr) plant, then F_1 offsprings have pink (Rr) flowers.



Phenotypic ratio → 1 : 2 : 1 (1 Red : 2 Pink : 1 White)

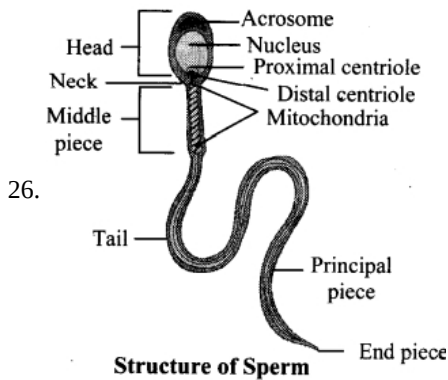
Genotypic ratio → 1 : 2 : 1 (1 RR : 2 Rr : 1 rr)

23. i. **Reflex action** is a sudden, spontaneous automatic, involuntary response to stimulus. The response to stimulus is said to be involuntary as it is carried out without any conscious effort by the brain. Thus reflex actions are significant in protecting us from sudden stimulus that can harm us and essential for our survival.
- ii. The path along which the reflex action is carried out is called **reflex arc**.
- iii. The reflex pathway comprises of at least one afferent neuron (receptor) and one efferent (effector or excitor) neuron appropriately arranged in a series.
- iv. The afferent neuron receives signal from a sensory organ and transmits the impulse via a dorsal nerve root into the CNS (at the level of spinal cord).
- v. The efferent neuron then carries signals from CNS to the effector. The stimulus and response thus forms a reflex arc.
24. Answer the following:
- (i) 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



25. i. The pressure exerted by blood on the wall of the blood vessels is called blood pressure.
- ii. It is measured by the sphygmomanometer. It is usually measured from the arteries.

iii.	No.	Arteries	Veins
	i.	They are thick walled.	They are thin walled.
	ii.	Lumen is narrow.	Lumen is wide.



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

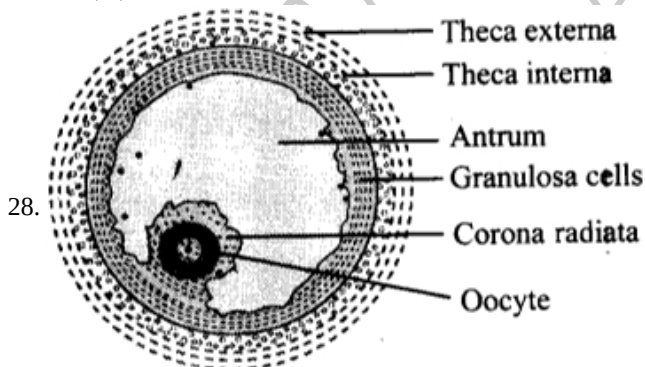
27. Answer the following:

(i) The blind spot is the region of retina where rods and cones are absent.

(ii) i. **Role of hormone relaxin:** It relaxes the cervix of the pregnant female and the ligaments of pelvic girdle to ease out the birth process.

ii. **Role of hormone inhibin:** Inhibin inhibits the FSH and GnRH production.

(iii) Cretinism



Graafian Follicle

Structure of Graafian follicle:

i. The Graafian follicle is a mature ovarian follicle.

ii. The secondary oocyte is located eccentrically (away from the centre) and is surrounded by a non-cellular layer of zona pellucida secreted by the vitelline membrane of oocyte.

iii. There are three layers covering the Graafian follicle. They are as follows:

a. The outermost protective and fibrous covering is called theca externa.

b. Inner to it is cellular theca interna which produces the hormone oestrogen.

- c. Inner to the theca interna, the follicular cells form the membrana granulosa.
- iv. From the membrana granulosa, the cells differentiate into discus proligerus and the corona radiata cells.
- v. Oocyte and the surrounding granulosa cells are together termed as Cumulus oophorus.
- vi. A fluid filled cavity called antrum lies between the oocyte and the membrana granulosa. It is filled with a fluid called liquor folliculi.

[In diagram of Graafian follicle label only oocyte and antrum]

29. Answer the following:

- (i) Mohsin is suffering from hypertension.

Hypertension or deviation from normal blood pressure value may be due to high or low blood volume, arterial inelasticity or hardening of arteries (arteriosclerosis), deposition of fats like cholesterol in the arteries (atherosclerosis), renal diseases and emotion induced hormonal changes, obesity, etc.

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

- (iii) T wave represents ventricular diastole.

30. Recombinant DNA (r-DNA) technology is defined as the manipulation of genetic material towards a desired end and in a directed and predetermined way using in vitro process.

For the steps of r-DNA technology:

i. Isolation of DNA (gene) from the donor organism:

- a. The desired gene to be cloned is obtained from the source organism (donor).
- b. Initially the cells of the donor organism are sheared with the blender and treated with suitable detergent.
- c. Genetic material from the donor is isolated and purified using several techniques.
- d. Isolated DNA can be spooled on to a glass rod.

ii. Cutting of desired gene:

- a. Isolated purified DNA is then cleaved by using restriction enzymes i.e. restriction endonucleases.
- b. These enzymes cleave DNA at restriction sites and break the DNA into fragments.
- c. There are several types of restriction endonucleases.
- d. Cleaved DNA fragments have cohesive, sticky, staggered ends or blunt ends.
- e. From cleaved DNA fragments, a fragment containing desired gene is isolated and selected for cloning. This is now called foreign DNA or passenger DNA.
- f. A desired gene can also be obtained directly from genomic library or cDNA library.

iii. Insertion of desired foreign gene into a cloning vector (vehicle DNA):

- a. The foreign DNA or passenger DNA is now inserted into a cloning vector or vehicle DNA.
- b. The most commonly used cloning vectors are plasmids of bacteria and the bacteriophage viruses like lambda phage and M13.
- c. The most commonly used plasmid is pBR 322.
- d. Plasmids are isolated from the vector organisms i.e. bacterium.
- e. By using same restriction enzyme (which is used in the isolation of the desired gene from the donor), plasmid i.e. vector DNA is cleaved.
- f. Now by using enzyme DNA ligase, foreign DNA is inserted/ integrated into the vector DNA.
- g. The combination of vector DNA and foreign DNA is now called Recombinant DNA or Chimeric DNA and the technology is referred to as rDNA technology.

iv. Transfer of rDNA into suitable competent host or cloning organism:

- a. Finally the recombinant DNA is transferred for expression into a competent host cell which is usually a bacterium.
- b. Host cell takes up naked rDNA by process of 'transformation' and incorporates into its own chromosomal DNA which finally expresses the trait controlled by passenger DNA.
- c. The transfer of rDNA into a bacterial cell is assisted by divalent Ca^{++} .
- d. The cloning organisms used in plant biotechnology are E. coli and Agrobacterium tumefaciens.
- e. The host/ competent cell which has taken up rDNA is now called transformed cell.
- f. Foreign DNA can also be transferred directly into the naked cell or protoplast of the competent host cell, without using vector.
- g. This is done by using techniques like electroporation, microinjection, lipofection, shot gun, ultra-sonification, biolistic method, etc. But in plant biotechnology the transformation is through Ti plasmids of A. tumefaciens.

v. Selection of the transformed host cell:

- a. The transformation process generates a mixed population of transformed (recombinant) and non-transformed (non-recombinant) host cells.
- b. For isolation of recombinant cell from nonrecombinant cell, marker gene of plasmid vector is employed.
- c. For example, pBR322 plasmid vector contains different marker gene (Ampicillin resistant gene and Tetracycline resistant gene).
- d. When PstI restriction enzyme is used, it knocks out Ampicillin resistant gene from the plasmid, so that the recombinant cell becomes sensitive to Ampicillin.

vi. **Multiplication of transformed host cell:**

- a. Once transformed, host cells are separated by the screening process.
- b. In this step the transformed host cells are introduced into fresh culture media.
- c. At this stage the host cells multiply along with the replication of the recombinant DNA carried by them.

vii. **Expression of the gene to obtain the desired product:**

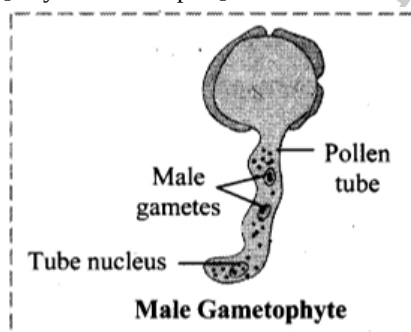
- a. The next step involves the production of desired products like alcohol, enzymes, antibiotics, etc.
- b. Finally the desired product is separated and purified through downstream processing using suitable bioreactor.

Therapeutic products produced by r-DNA technology are as follows:

	Recombinant Protein	It's use in or for
i.	Platelet derived growth factor	Atherosclerosis
ii.	α - antitrypsin	Emphysema
iii.	Relaxin	Parturition
iv.	Erythropoietin	Anaemia
v.	Factor VIII	Haemophilia A
vi.	DNase	Cystic fibrosis
vii.	Interferons, tumour necrosis factor, interleukins, macrophage activating factor	Cancer
viii.	Insulin	Diabetes
ix.	Interleukin-1 receptor	Asthma
x.	Factor IX	Haemophilia B
xi.	Urokinase, Tissue plasminogen activator	Dissolving blood clot

[Any three examples]

31.



- i. Pollen grain/microspore marks the beginning of male gametophyte, thus it is the first cell of the male gametophyte.
- ii. It undergoes first mitotic division to produce bigger, naked vegetative cell and small, thin walled generative cell.
- iii. The vegetative cell is rich in food and having irregular shaped nucleus.
- iv. The generative cell floats in the cytoplasm of vegetative cell.
- v. The second mitotic division is concerned with generative cell only and gives rise to two nonmotile male gametes.
- vi. The mitotic division of generative cell takes place either in pollen grain or in the pollen tube.
- vii. The pollen grains are shed from the anther, at this two-celled stage in most of the angiosperms.
- viii. The pollen tube consisting of two male gametes and a degenerating sterile vegetative nucleus represents the male gametophyte.