Question 3:

Arrange the following terms in the correct developmental sequence:

Pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell, male gametes

Answer

The correct development sequence is as follows:

Sporogenous tissue – pollen mother cell – microspore tetrad – Pollen grain – male gamete

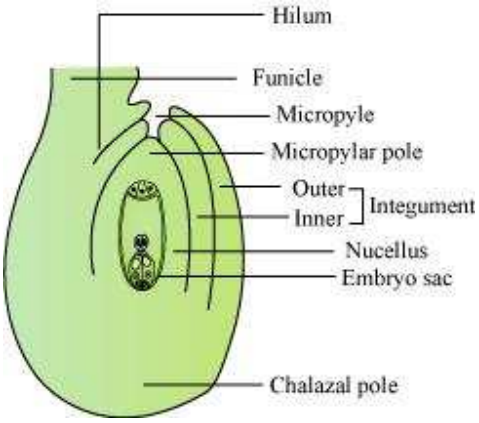
During the development of microsporangium, each cell of the sporogenous tissue acts as a pollen mother cell and gives rise to a microspore tetrad, containing four haploid microspores by the process of meiosis (microsporogenesis). As the anther matures, these microspores dissociate and develop into pollen grains. The pollen grains mature and give rise to male gametes.

Question 4:

With a neat, labelled diagram, describe the parts of a typical angiosperm ovule.

Answer

An ovule is a female megasporangium where the formation of megaspores takes place.



The various parts of an ovule are –

(1) Funiculus – It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary.

(2) Hilum – It is the point where the body of the ovule is attached to the funiculus.

(3) Integuments –They are the outer layers surrounding the ovule that provide protection to the developing embryo.

(4) Micropyle – It is a narrow pore formed by the projection of integuments. It marks the point where the pollen tube enters the ovule at the time of fertilization.

(5) Nucellus – It is a mass of the parenchymatous tissue surrounded by the integuments from the outside. The nucellus provides nutrition to the developing embryo. The embryo sac is located inside the nucellus.

(6) Chalazal – It is the based swollen part of the nucellus from where the integuments originate.

Question 5:

What is meant by monosporic development of female gametophyte?

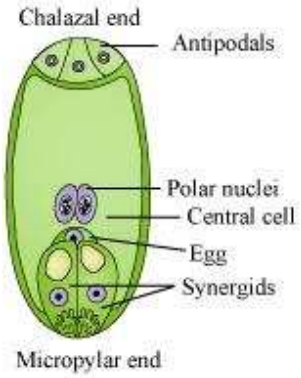
Answer

The female gametophyte or the embryo sac develops from a single functional megaspore. This is known as monosporic development of the female gametophyte. In most flowering plants, a single megaspore mother cell present at the micropylar pole of the nucellus region of the ovule undergoes meiosis to produce four haploid megaspores. Later, out of these four megaspores, only one functional megaspore develops into the female gametophyte, while the remaining three degenerate.

Question 6:

With a neat diagram explain the 7-celled, 8-nucleate nature of the female gametophyte.

Answer



The female gametophyte (embryo sac) develops from a single functional megaspore. This megaspore undergoes three successive mitotic divisions to form eight nucleate embryo sacs.

The first mitotic division in the megaspore forms two nuclei. One nucleus moves towards the micropylar end while the other nucleus moves towards the chalazal end. Then, these nuclei divide at their respective ends and re-divide to form eight nucleate stages. As a result, there are four nuclei each at both the ends i.e., at the micropylar and the chalazal end in the embryo sac. At the micropylar end, out of the four nuclei only three differentiate into two synergids and one egg cell. Together they are known as the egg apparatus. Similarly, at the chalazal end, three out of four nuclei differentiates as antipodal cells. The remaining two cells (of the micropylar and the chalazal end) move towards the centre and are known as the polar nuclei, which are situated in a large central cell. Hence, at maturity, the female gametophyte appears as a 7-celled structure, though it has 8 nucleate.

Question 7:

What are chasmogamous flowers? Can cross-pollination occur in cleistogamous flowers? Give reasons for your answer.

Answer

There are two types of flowers present in plants namely *Oxalis* and *Viola* – chasmogamous and cleistogamous flowers. Chasmogamous flowers have exposed anthers and stigmata similar to the flowers of other species.

Cross-pollination cannot occur in cleistogamous flowers. This is because cleistogamous flowers never open at all. Also, the anther and the stigma lie close to each other in these flowers. Hence, only self-pollination is possible in these flowers.

Question 8:

Mention two strategies evolved to prevent self-pollination in flowers.

Answer

Self-pollination involves the transfer of pollen from the stamen to the pistil of the same flower. Two strategies that have evolved to prevent self-pollination in flowers are as follows:

(1) In certain plants, the stigma of the flower hasthecapability to prevent the germination of pollen grains and hence, prevent the growth of the pollen tube.It is a genetic mechanism to prevent self-pollination called **self- incompatibility**. Incompatibility may be between individuals of the same species or between individuals of different species. Thus, incompatibility prevents breeding.

(2) In some plants, the gynoecium matures before the androecium or vice-versa. This phenomenon is known as **protogyny** or **protandry** respectively. This prevents the pollen from coming in contact with the stigma of the same flower.

Question 9:

What is self-incompatibility? Why does self-pollination not lead to seed formation in self-incompatible species?

Answer

Self-incompatibility is a genetic mechanism in angiosperms that prevents self-pollination. It develops genetic incompatibility between individuals of the same species or between individuals of different species.

The plants which exhibit this phenomenon have the ability to prevent germination of pollen grains and thus, prevent the growth of the pollen tube on the stigma of the flower. This prevents the fusion of the gametes along with the development of the embryo. As a result, no seed formation takes place.

Question 10:

What is bagging technique? How is it useful in a plant breeding programme?

Answer

Various artificial hybridization techniques (under various crop improvement programmes) involve the removal of the anther from bisexual flowers without affecting the female reproductive part (pistil) through the process of emasculation. Then, these emasculated flowers are wrapped in bags to prevent pollination by unwanted pollen grains. This process is called bagging.

This technique is an important part of the plant breeding programme as it ensures that pollen grains of only desirable plants are used for fertilization of the stigma to develop the desired plant variety.

Question 11:

What is triple fusion? Where and how does it take place? Name the nuclei involved in triple fusion.

Answer

Triple fusion is the fusion of the male gamete with two polar nuclei inside the embryo sac of the angiosperm.

This process of fusion takes place inside the embryo sac.

When pollen grains fall on the stigma, they germinate and give rise to the pollen tube that passes through the style and enters into the ovule. After this, the pollen tube enters one of synergids and releases two male gametes there. Out of the two male gametes, one gamete fuses with the nucleus of the egg cell and forms the zygote (syngamy). The other male gamete fuses with the two polar nuclei present in the central cell to form a triploid primary endosperm nucleus. Since this process involves the fusion of three haploid nuclei, it is known as triple fusion. It results in the formation of the endosperm.

One male gamete nucleus and two polar nuclei are involved in this process.

Question 12:

Why do you think the zygote is dormant for sometime in a fertilized ovule?

Answer

The zygote is formed by the fusion of the male gamete with the nucleus of the egg cell. The zygote remains dormant for some time and waits for the endosperm to form, which develops from the primary endosperm cell resulting from triple fusion. The endosperm provides food for the growing embryo and after the formation of the endosperm, further development of the embryo from the zygote starts.

Question 13:

Differentiate between:

(a) Hypocotyl and epicotyl;

(b) Coleoptile and coleorrhiza;

(c) Integument and testa;

(d) Perisperm and pericarp.

Answer

Differentiate between

(a)

	Hypocotyl	**Epicotyl**
1.	The portion of the embryonal axis which lies below the cotyledon in a dicot embryo is known as the hypocotyl.	The portion of the embryonal axis which lies above the cotyledon in a dicot embryo is known as the epicotyl.
2.	It terminates with the radicle.	It terminates with the plumule.

(b)

Coleoptile	**Coleorrhiza**

	It is a conical protective sheath that encloses the plumule in a monocot seed.	It is an undifferentiated sheath that encloses the radicle and the root cap in a monocot seed.

(c)

Integument	**Testa**
It is the outermost covering of an ovule. It provides protection to it.	It is the outermost covering of a seed.

(d)

Perisperm	**Pericarp**
It is the residual nucellus which persists. It is present in some seeds such as beet and black pepper.	It is the ripened wall of a fruit, which develops from the wall of an ovary.

Question 14:

Why is apple called a false fruit? Which part(s) of the flower forms the fruit?

Answer

Fruits derived from the ovary and other accessory floral parts are called false fruits. On the contrary, true fruits are those fruits which develop from the ovary, but do not consist of the thalamus or any other floral part. In an apple, the fleshy receptacle forms the main edible part. Hence, it is a false fruit.

Question 15:

What is meant by emasculation? When and why does a plant breeder employ this technique?

Answer

Emasculation is the process of removing anthers from bisexual flowers without affecting the female reproductive part (pistil), which is used in various plant hybridization techniques.

Emasculation is performed by plant breeders in bisexual flowers to obtain the desired variety of a plant by crossing a particular plant with the desired pollen grain. To remove the anthers, the flowers are covered with a bag before they open. This ensures that the flower is pollinated by pollen grains obtained from desirable varieties only. Later, the mature, viable, and stored pollen grains are dusted on the bagged stigma by breeders to allow artificial pollination to take place and obtain the desired plant variety.

Question 16:

If one can induce parthenocarpy through the application of growth substances, which fruits would you select to induce parthenocarpy and why?

Answer

Parthenocarpy is the process of developing fruits without involving the process of fertilization or seed formation. Therefore, the seedless varieties of economically important fruits such as orange, lemon, water melon etc. are produced using this technique. This technique involves inducing fruit formation by the application of plant growth hormones such as auxins.

Question 17:

Explain the role of tapetum in the formation pollen-grain wall.

Answer

Tapetum is the innermost layer of the microsporangium. It provides nourishment to the developing pollen grains. During microsporogenesis, the cells of tapetum produce various enzymes, hormones, amino acids, and other nutritious material required for the development of pollen grains. It also produces the exine layer of the pollen grains, which is composed of the sporopollenin.

Question 18:

What is apomixis and what is its importance?

Answer

Apomixis is the mechanism of seed production without involving the process of meiosis and syngamy. It plays an important role in hybrid seed production. The method of producing hybrid seeds by cultivation is very expensive for farmers. Also, by sowing hybrid seeds, it is difficult to maintain hybrid characters as characters segregate during meiosis. Apomixis prevents the loss of specific characters in the hybrid. Also, it is a cost-effective method for producing seeds.

Question 1:

Fill in the blanks:

(a) Humans reproduce _____. (asexually/sexually)

(b) Humans are_____. (oviparous/viviparous/ovoviviparous)

(c) Fertilization is _____ in humans. (external/internal)

(d) Male and female gametes are _____. (diploid/haploid)

(e) Zygote is _____. (diploid/haploid)

(f) The process of release of the ovum from a mature follicle is called_____.

(g) Ovulation is induced by a hormone called the _____.

(h) The fusion of the male and the female gametes is called _____.

(i) Fertilization takes place in the _____.

(j) The zygote divides to form _____, which is implanted in uterus.

(k) The structure which provides vascular connection between the fetus and uterus is called _____.

Answer

(a) Humans reproduce sexually.

(b) Humans are viviparous.

(c) Fertilization is internal in humans.

(d) Male and female gametes are haploid.

(e) Zygote is diploid.

(f) The process of release of the ovum from a mature follicle is called ovulation.

(g) Ovulation is induced by a hormone called the luteinizing hormone.

(h) The fusion of the male and the female gametes is called fertilization.

(i) Fertilization takes place in the fallopian tube.

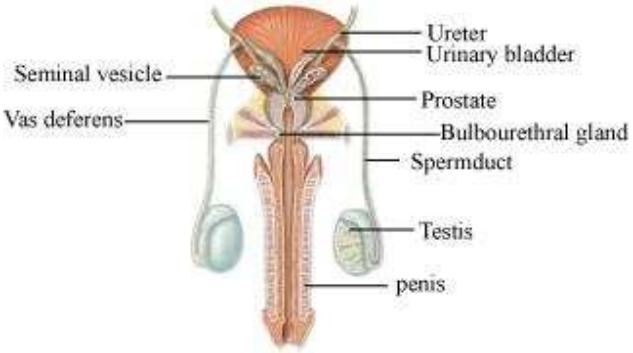
(j) The zygote divides to form blastocyst, which is implanted in uterus.

(k) The structure which provides vascular connection between the fetus and uterus is called placenta.

Question 2:

Draw a labeled diagram of male reproductive system.

Answer

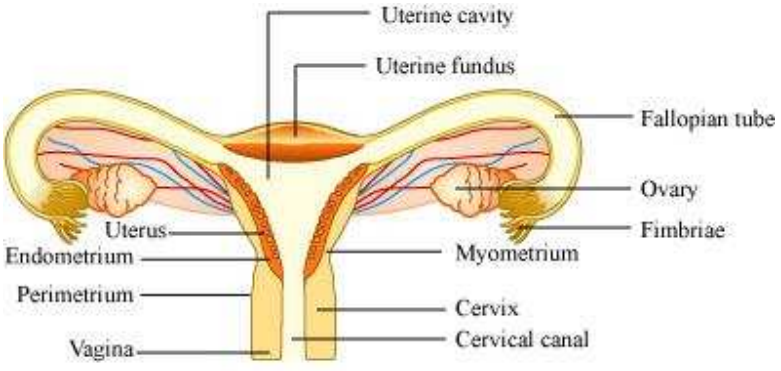


The male reproductive system

Question 3:

Draw a labeled diagram of female reproductive system.

Answer



The female reproductive system

Question 4:

Write two major functions each of testis and ovary.

Answer

Functions of the Testis:

(a) They produce male gametes called spermatozoa by the process of spermatogenesis.

(b) The leydig cells of the seminiferous tubules secrete the male sex hormone called testosterone. Testosterone aids the development of secondary sex characteristics in males.

Functions of the ovary:

(a) They produce female gametes called ova by the process of oogenesis.

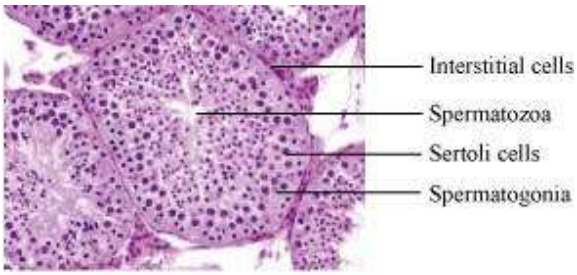
(b) The growing Graffian follicles secrete the female sex hormone called estrogen. Estrogen aids the development of secondary sex characteristics in females.

Question 5:

Describe the structure of a seminiferous tubule.

Answer

The production of sperms in the testes takes place in a highly coiled structure called the seminiferous tubules. These tubules are located in the testicular lobules. Each seminiferous tubule is lined by germinal epithelium. It is lined on its inner side by two types of cells namely spermatogonia and sertoli cells respectively. Spermatogonia are male germ cells which produce primary spermatocytes by meiotic divisions. Primary spermatocytes undergo further meiotic division to form secondary spermatocytes and finally, spermatids. Spermatids later metamorphoses into male gametes called spermatozoa. Sertoli cells are known as nurse cells of the testes as they provide nourishment to the germ cells. There are large polygonal cells known as interstitial cells or leydig cells just adjacent to seminiferous tubules. These cells secrete the male hormone called testosterone.



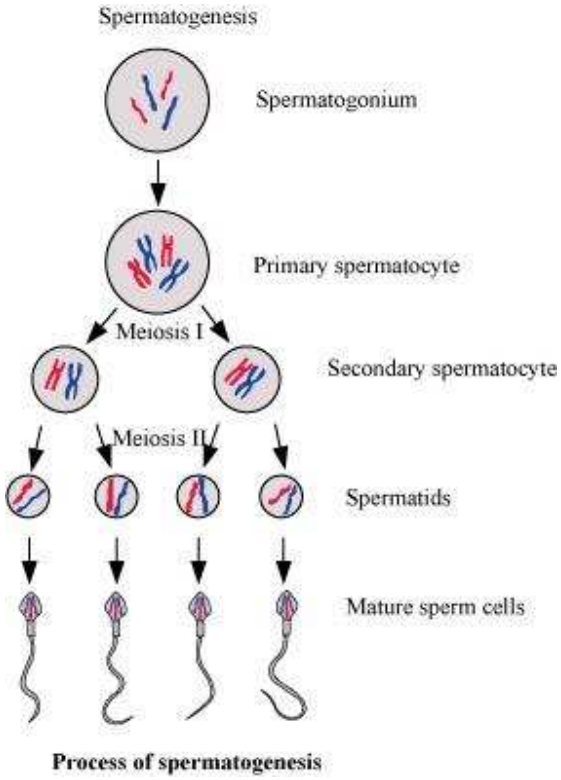
Transverse section of seminiferous tubules

Question 6:

What is spermatogenesis? Briefly describe the process of spermatogenesis.

Answer

Spermatogenesis is the process of the production of sperms from the immature germ cells in males. It takes place in seminiferous tubules present inside the testes. During spermatogenesis, a diploid spermatogonium (male germ cell) increases its size to form a diploid primary spermatocyte. This diploid primary spermatocyte undergoes first meiotic division (meiosis I), which is a reductional division to form two equal haploid secondary spermatocytes. Each secondary spermatocyte then undergoes second meiotic division (meiosis II) to form two equal haploid spermatids. Hence, a diploid spermatogonium produces four haploid spermatids. These spermatids are transformed into spermatozoa (sperm) by the process called spermiogenesis.



Process of spermatogenesis

Question 7:

Name the hormones involved in regulation of spermatogenesis.

Answer

Follicle-stimulating hormones (FSH) and luteinizing hormones (LH) are secreted by gonadotropin releasing hormones from the hypothalamus .These hormones are involved in the regulation of the process of spermatogenesis. FSH acts on sertoli cells, whereas LH acts on leydig cells of the testis and stimulates the process of spermatogenesis.

Question 8:

Define spermiogenesis and spermiation.

Answer

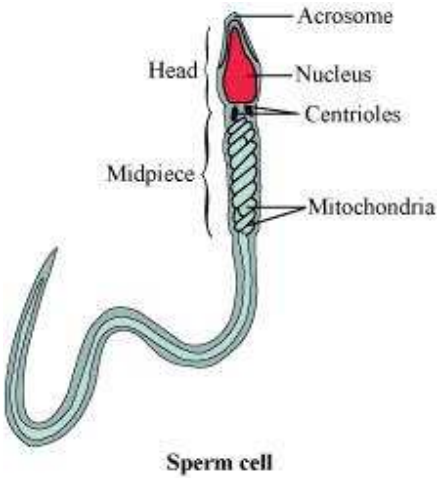
Spermiogenesis: It is the process of transforming spermatids into matured spermatozoa or sperms.

Spermiation: It is the process when mature spermatozoa are released from the sertoli cells into the lumen of seminiferous tubules.

Question 9:

Draw a labeled diagram of sperm.

Answer



Sperm cell

Question 10:

What are the major components of seminal plasma?

Answer

Semen (produced in males) is composed of sperms and seminal plasma. The major components of the seminal plasma in the male reproductive system are mucus, spermatozoa, and various secretions of accessory glands. The seminal plasma is rich in fructose, calcium, ascorbic acid, and certain enzymes. It provides nourishment and protection to sperms.

Question 11:

What are the major functions of male accessory ducts and glands?

Answer

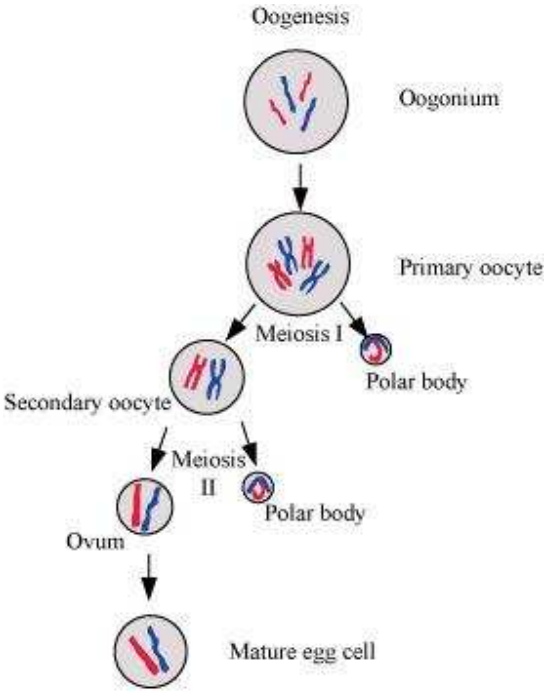
The male accessory ducts are vasa efferentia, epididymis, vas deferens, and rete testis. They play an important role in the transport and temporary storage of sperms. On the contrary, male accessory glands are seminal vesicles, prostate glands, and bulbourethral glands. These glands secrete fluids that lubricate the reproductive system and sperms. The sperms get dispersed in the fluid which makes their transportation into the female body easier. The fluid is rich in fructose, ascorbic acid, and certain enzymes. They also provide nutrients and activate the sperm.

Question 12:

What is oogenesis? Give a brief account of oogenesis.

Answer

Oogenesis is the process of the formation of a mature ovum from the oogonia in females. It takes place in the ovaries. During oogenesis, a diploid oogonium or egg mother cell increases in size and gets transformed into a diploid primary oocyte. This diploid primary oocyte undergoes first meiotic division i.e., meiosis I or reductional division to form two unequal haploid cells. The smaller cell is known as the first polar body, while the larger cell is known as the secondary oocyte. This secondary oocyte undergoes second meiotic division i.e., meiosis II or equational division and gives rise to a second polar body and an ovum. Hence, in the process of oogenesis, a diploid oogonium produces a single haploid ovum while two or three polar bodies are produced.

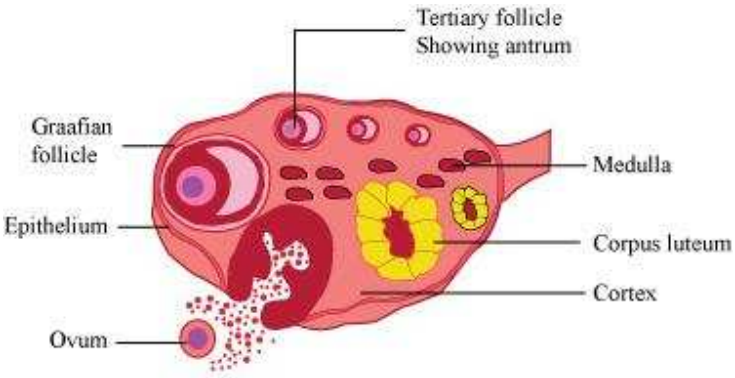


Process of oogenesis

Question 13:

Draw a labeled diagram of a section through ovary.

Answer



Transerve section of the ovary