

Human Reproduction

EXAM
DRILL

ANSWERS

1. Failure of testes to descend into scrotum causes sterility because spermatogenesis requires a temperature lower by $2 - 2.5^{\circ}\text{C}$ than the internal body temperature which is provided by scrotum.
2. Sperms are tailed whereas eggs do not, as sperms have to move (tail helps in locomotion) through the cervix, uterus and fallopian tube to reach the egg which is already present there.
3. The given figure is of blastocyst and the part labelled 'A' is trophoblast.
4. Oxytocin is called birth hormone as it causes contraction of uterus during child birth.

OR

The trophoblast layer provides nourishment to the embryo and form extra-embryonic membranes.

5. Spermlysins are hydrolytic enzymes released by acrosome during fertilisation. They help the sperm to penetrate the egg.
6. Zona pellucida is surrounded by follicular cells called membrana granulosa.
7. (c)
8. (c)
9. (d): The yolk sac is non-functional in human beings except that it functions as the site of early blood cell formation.
10. (d)
11. (a): The myometrium is a middle thick layer of smooth muscle fibres which shows strong contractions during delivery of the baby.
12. (d): A single ejaculation of semen by male contains 200 to 300 million sperms, of which for normal fertility atleast 60 per cent sperms must have normal shape and size and atleast 40 per cent of them must show vigorous motility.
13. (d): The process of delivery of the fetus (childbirth) is called parturition. Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed fetus and the placenta which induce mild uterine contractions called fetal ejection reflex. This triggers release of oxytocin from the maternal pituitary. Oxytocin acts on the uterine muscles and causes stronger uterine contractions, which in turn stimulate further secretion of oxytocin. The stimulatory reflex between the uterine contractions and oxytocin secretion continues resulting

in stronger and stronger contractions. This leads to expulsion of the baby out of the uterus through the birth canal.

14. (d): In menstrual phase, the endometrium of the uterus breaks down.

15. (i) (d)

(ii) (b): Colostrum is the first milk which comes from the mammary glands of the mother just after child birth, for 2 or 3 days.

(iii) (d): Mineral salts like sodium, calcium, potassium phosphorus are main constituents of human milk. Milk is poor in iron content.

(iv) (c)

(v) (b): Colostrum contains IgA antibodies that provides immunity to the new born infant.

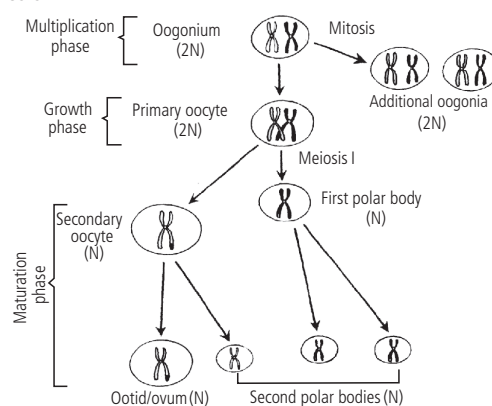
16. (i) At point of contact with the sperms, the secondary oocyte forms projection cone termed fertilisation cone to receive the sperm.

(ii) Sperms are produced in large numbers to ensure fertilisation of the ovum. In female reproductive tract, there are various obstructions as sperms swim up to meet the ovum. Some sperms die due to vaginal secretions, or due to their short life span.

(iii) (b)

(iv) (c) Mixing up of chromosomes of sperm and an ovum is known as karyogamy or amphimixis and fertilised ovum is now called zygote.

17. The process of formation of ovum from oogonium is called oogenesis. The given flow chart shows various stages of oogenesis :



18. (a) Follicular phase extends from 6th to 13th days of menstrual cycle. During follicular phase, ovarian follicle secretes estrogen under the influence of FSH secreted by anterior pituitary. Estrogen stimulates the proliferation of the endometrium of the uterine wall.

(b) Luteal phase is from day 15-28 in menstrual cycle. During luteal phase, the remaining cells of the ovarian follicles after ovulation are stimulated by LH to develop corpus luteum. The corpus luteum secretes progesterone that stimulates the uterine glands to produce increased amount of mucus and is also essential for the maintenance of the endometrium which is necessary for implantation of the fertilised ovum.

19. Differences between cleavage and mitosis are :

	Cleavage	Mitosis
(i)	It occurs in zygote or parthenogenetic egg.	It occurs in most of body cells.
(ii)	Size of blastomeres decreases.	Size of daughter cells remains same after growth.
(iii)	Growth does not occur.	Growth occurs during interphase.
(iv)	Oxygen consumption is high as it is very rapid process.	Oxygen consumption is low as it is slow process.

20. The placenta acts as an endocrine gland and secretes the following hormones :

(i) Human chorionic gonadotropin (hCG) stimulates and maintains the corpus luteum to secrete progesterone until the end of pregnancy.

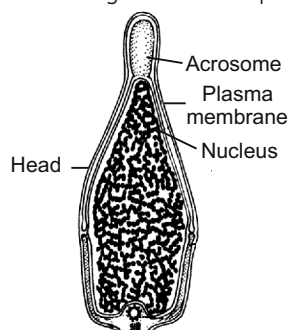
(ii) Human chorionic somatomammotropin (hCS) stimulates the growth of the mammary glands during pregnancy.

(iii) Progesterone and estrogen are necessary for supporting the fetal growth, metabolic changes in mother and maintenance of pregnancy.

(iv) Relaxin facilitates parturition (act of birth) by softening the connective tissues of the pubic symphysis.

21. Myometrium is middle thick layer of smooth muscle fibres that brings about contraction of the uterus during the delivery of the baby. The endometrium is the inner glandular layer that undergoes cyclical changes during the menstrual cycle.

22. Labelled parts of head region of human sperm are as follows:



OR

High concentration of LH causes rupturing of Graafian follicle and thereby the release of ovum. This is called ovulation, which occurs during 14th day of menstrual cycle.

23. Due to acrosomal reaction, plasma membrane of sperm fuses with the plasma membrane of secondary oocyte so that sperm contents enter the oocyte. Binding of sperm to oocyte induces depolarisation of oocyte plasma membrane and this prevents polyspermy (entry of more than one sperm into oocyte) and ensures monospermy.

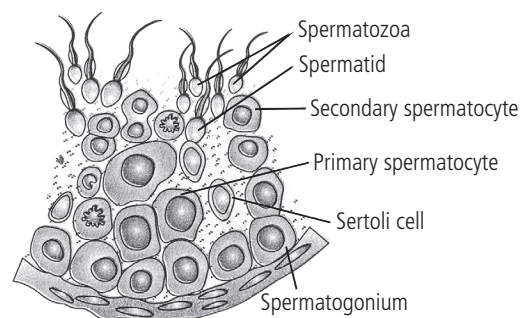
24. (a) 1 (b) 8–16 (c) 64

25. After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (fetus) and maternal body called placenta, which facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory waste materials produced by the embryo.

Placenta also acts as an endocrine tissue and produces several hormones essential for supporting the fetal growth, metabolic changes in the mother and maintenance of pregnancy.

26. All young mothers must breast-feed their newborn babies to provide best nourishment to them. Human milk consists of fat, casein (milk protein), lactose (milk sugar), mineral salts (sodium, calcium, potassium, phosphorus, etc.) and vitamins that are necessary for development of the child. Mammary glands start producing milk at the end of pregnancy. The milk produced by the mammary glands of mother during initial days after child birth, for 2 to 3 days is called colostrum. It is rich in proteins (lactalbumin and lactoprotein) and various other nutrients. It also contains certain antibodies (IgA), which provide passive immunity to the baby. This milk helps in developing resistance to disease for newborn babies. It helps the baby to fight from viruses and bacteria. It is also easily digested by the baby with no constipation or diarrhoea.

27. Sectional view of human seminiferous tubule is as follows:



28. (a) Sperm 'A' would reach the ovum earlier than both sperms 'B' and 'C'.

(b) In the given diagram, 'D' is corona radiata that is formed of radially elongated follicular cells. 'E' is zona pellucida that is present outside the perivitelline space.

The function of the zona pellucida is to prevent the implantation of the blastocyst at an abnormal site. It does not expose the sticky and phagocytic cells of the trophoblast till the blastocyst reaches the proper implantation site. As the blastocyst is formed, zona pellucida becomes thinner and finally disappears.

(c) The sperms in the female genital tract are made capable of fertilising the egg by secretions of the female genital tract. These secretions remove coating substances deposited on the surface of sperm, mainly on acrosome and exposes its receptor sites. The phenomenon of sperm activation in mammals is known as capacitation.

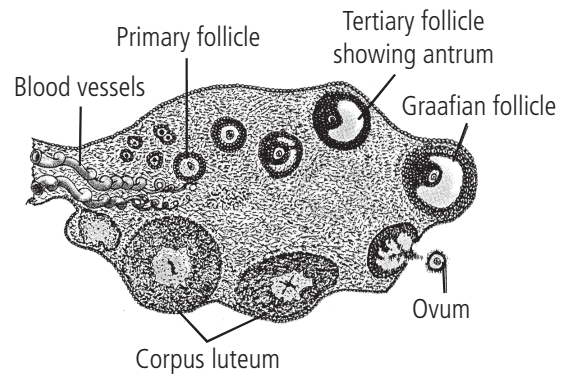
The capacitated sperms undergo acrosomal reaction and release various chemicals contained in the acrosome. These chemicals are collectively called sperm lysins. Due to acrosomal reaction, plasma membrane of the sperm fuses with the plasma membrane of the secondary oocyte, so that the sperm contents enter the oocyte.

(d) Fertilisation takes place in the ampullary isthmic junction of the fallopian tube.

29. (a) : Primary oocytes are formed inside the ovary during the embryonic developmental stage. Oogenesis is initiated during the embryonic development stage when oogonia are formed within each fetal ovary. These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes. Each primary oocyte then gets surrounded by a layer of granulosa cells and is called the primary follicle. The primary follicles get surrounded by more layers of granulosa cells and a new theca and are called secondary follicles.

The secondary follicle soon transforms into a tertiary follicle which is characterised by fluid filled cavity called antrum. The theca layer is organised into an inner theca interna and an outer theca externa. The primary oocyte within the tertiary follicle grows in size and completes its first meiotic division. It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body. The tertiary follicle further changes into the mature follicle or Graafian follicle. The secondary oocyte forms a new membrane called zona pellucida surrounding it. The Graafian follicle now ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.

(b) : The labelled diagram of sectional view of human ovary is as follows :

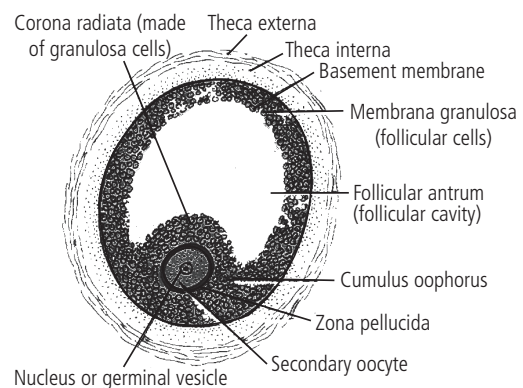


30. The differences between spermatogenesis and oogenesis are as follows :

	Spermatogenesis	Oogenesis
(i)	It occurs in the testes.	It occurs in the ovaries.
(ii)	Spermatogonia change to primary spermatocytes.	Oogonia change to primary oocytes.
(iii)	A primary spermatocyte divides to form two secondary spermatocytes.	A primary oocyte divides to form one secondary oocyte and one polar body.
(iv)	A secondary spermatocyte divides to form two spermatids.	A secondary oocyte divides to form one ootid and one polar body.
(v)	A spermatogonium forms four spermatozoa.	An oogonium forms one ovum.

OR

The labelled diagram of Graafian follicle is as follows :



31. (a) Primary oocytes will be present in ovary (X) of a newborn baby.

(b) Y is fimbriae. The edges of the infundibulum of fallopian tubes possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation.

(c) Z is the ampullary-isthmic junction. It is the site of fertilisation in humans.

OR

(a) Placenta develops after implantation of embryo in the uterus of human female. After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (fetus) and maternal body called placenta, which facilitates the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory waste materials produced by the embryo.

(b) An umbilical cord connects placenta to the embryo.

(c) Colostrum is the first milk secreted from mammary glands just after childbirth. It is yellowish fluid rich in cells of alveoli and rich in protein (lactalbumin and lactoprotein) but low in fat.

32. The events of fertilisation in human female are :

(i) Acrosomal reaction : After ovulation, the secondary oocyte reaches the fallopian tube. The capacitated sperm releases hydrolytic enzymes (spermlysins) present in the acrosome, when it comes in contact with surface of egg covering. Important sperm lysins are : (1) hyaluronidase that acts on the ground substances of follicle cells, (2) corona penetrating enzyme that dissolves corona radiata and (3) zona lysine or acrosin that helps to digest the zona pellucida. Due to acrosomal reaction, plasma membrane of sperm fuses with that of secondary oocyte and depolarisation of oocyte membrane occurs.

(ii) Cortical reaction : Immediately after the fusion of sperm and egg plasma membranes, the egg shows a cortical reaction to further check the entry of more sperms. In this reaction, the cortical granules present beneath the ovum's plasma membrane fuse with the same and release their contents (enzymes) between it and zona pellucida. These cortical enzymes harden the zona pellucida, which now functions as the sure block to polyspermy.

(iii) Sperm entry : At point of contact with sperms, the secondary oocyte forms finger-like processes, called microvilli, which constitute a fertilisation cone to receive the sperm. The distal centriole of the sperm divides and forms two centrioles to generate the mitotic spindle for cell division.

(iv) Karyogamy : The sperm entry stimulates the egg (secondary oocyte) to resume and complete the suspended meiosis - II. This produces a haploid mature ovum and a second polar body. The head of sperm separates from the middle piece and tail to become male pronucleus and nucleus of ovum is called female pronucleus. The second polar body and sperm tail degenerate. Mixing up of the chromosomes of a spermatozoon and an

ovum is called karyogamy or amphimixis. This completes the act of fertilisation. The fertilised ovum is now a diploid cell having 23 pairs of chromosomes, and is termed zygote.

OR

The growth, maintenance and functions of the female reproductive organs are under the hormonal control as described below.

GnRH is secreted by the hypothalamus which stimulates the anterior lobe of pituitary gland to secrete luteinising hormone (LH) and FSH. FSH stimulates the growth of the ovarian follicles and also increases the development of egg/oocyte within the follicle to complete the meiosis I to form secondary oocyte. FSH also stimulates the formation of estrogens. LH stimulates the corpus luteum to secrete progesterone. Progesterone helps in maintaining pregnancy as it thickens the endometrium. Rising level of progesterone inhibits the release of GnRH, which in turn, inhibits the production of FSH, LH and progesterone.

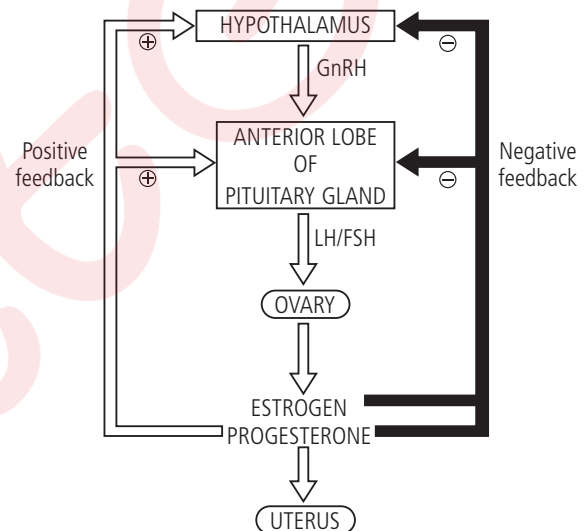


Fig.: Hormonal control of female reproductive system.

33. (a) : Gametogenesis is the process by which male and female gametes are formed respectively in testes and ovaries.

	Spermatogenesis	Oogenesis
(i)	Spermatogenesis initiates at puberty and continues till advance stage.	Oogenesis starts during fetal development, <i>i.e.</i> , even before birth.
(ii)	In spermatogenesis, four spermatozoa are formed from primary spermatocytes.	In oogenesis, only one ovum is formed from primary oocyte.

(b) : Leydig's cells or interstitial cells are present in between the seminiferous tubules in the connective tissue. These are endocrine portion of testes and secrete androgens (*e.g.*, testosterone) *i.e.*, male sex hormone.

OR

Number of chromosomes :

(a)

Spermatids - 23	Secondary oocyte - 23
Sertoli cells - 46	Spermatogonia - 46
Follicle cells - 46	Primary spermatocytes - 46

(b) On 15th day of menstrual cycle, the peak of luteinising

hormone together with prolactin hormone, stimulates follicular cells of the empty Graafian follicles to form yellow body called corpus luteum. It secretes progesterone and small amount of estradiol.

(c) Descent of testes into the scrotum is regulated by FSH. Failure of testes to descend into the scrotum causes sterility because sperm formation does not occur at the abdominal temperature.

© MXT ©

