HOW DO ORGANISMS REPRODUCE?

TOPIC 1

BASIC EVENTS IN REPRODUCTION

Reproduction is a biological process by which new individuals of the same species are produced by existing organisms. Reproduction is essential for the survival of a species on the earth. The process of reproduction ensures continuity of life on earth. Reproduction gives rise to more organisms with the same basic characteristics as their parents.

A basic event in reproduction is the creation of a DNA copy as the DNA in the cell nucleus is the information source for making proteins. If the information changes, different proteins will be made leading to altered body designs. Also, during cell division, an additional cellular apparatus is created so that the DNA copies separate, each with its own cellular apparatus.

Variation

Cells use chemical reactions to build copies of their DNA but this process of copying the DNA will have some variations due to which the DNA copies will be similar but not identical to the original. If the variations are so drastic that the new DNA copy cannot work with the cellular apparatus it inherits, then the newborn cell dies.

This tendency for variation during reproduction is the basis for evolution.

The Importance of Variation

Genetic variation is when the genes carried by the members of a population differ from one another (like hair or eye color). Genetic variation is important. If there are sudden changes in environment, the individuals of the population will vary enough that some will be able to adapt and survive.

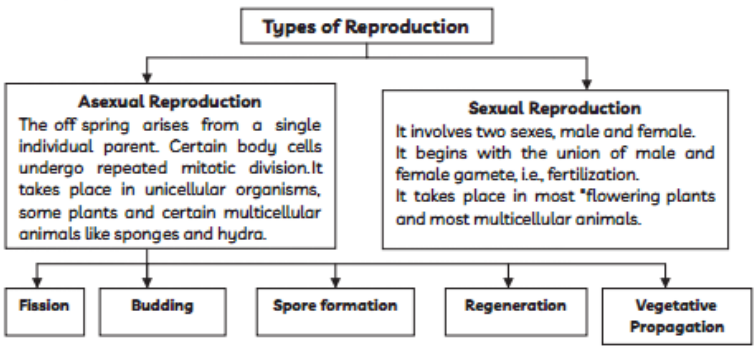
(1) It helps the species of various organisms to survive and flourish even in adverse environment due to the presence of some variations in some individual organisms to tolerate extreme changes in environmental conditions.

(2) It provides stability to the population of various species by preventing them from getting wiped out during adverse conditions.

TOPIC 2

TYPES OF REPRODUCTION

Living beings mainly reproduce by two methods–asexual reproduction and sexual reproduction. The modes by which different organisms reproduce depends on the body design of the organisms.



MOST LIKELY Questions

Short Answer Type-II Questions (SA-II)

[3 marks]

1. Explain how DNA copying is an essential part of the process of reproduction? What are the advantages of sexual reproduction over asexual reproduction?

Ans. DNA copying is an essential part of the process of reproduction because it makes possible the transmission of genetic information from parents to offspring in the next generation. DNA contains information for the inheritance of characteristics from the parents to the next generation.

Advantages of sexual reproduction over asexual reproduction:

(1) In sexual reproduction, more variations are produced. Thus, it ensures survival of species in a population.

(2) Variations favour evolution and play an important role in origin of new species.

(3) It maintains chromosome number in future generation.

(4) The new formed individual has characteristics of both the parents.

(5) Variations are more viable in sexual mode than in asexual one. This is because in asexual reproduction, DNA has to function inside the inherited cellular apparatus.

(Any 2 points can be written to get full marks.)

TOPIC 3

ASEXUAL REPRODUCTION

Characteristics

(1) Certain body cells of an organism undergo repeated mitotic divisions and form two or more new individuals of the same kind.

(2) The new individuals produced are genetically identical to their parents.

Advantages

(1) Asexual reproduction is simple and fast.

(2) Takes place in those organisms having simple body structures.

Disadvantages

(1) Evolutionary change is not possible as no variation is produced. A species consequently cannot adapt to changes in its environment.

(2) Asexual reproduction produces identical organisms generation after generation. In case of any defect in the parent organism, the offspring also inherits it.

Methods of Asexual Reproduction

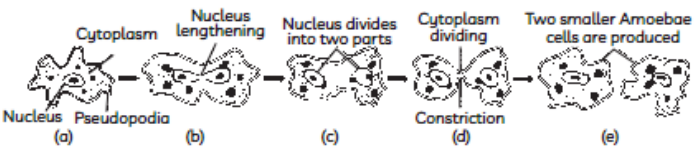
Asexual reproduction occurs in various ways which are described below:

Fission

It is the simplest method of asexual reproduction in unicellular organisms, such as amoeba, paramaecium and other protozoa.

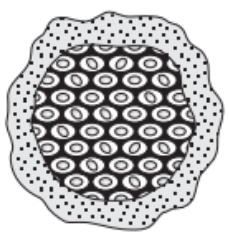
Different patterns of fission have been observed:

(A) In some organisms such as Amoeba, the splitting of the two cells during division takes place in any plane.



(B) In *Leishmania*, the binary fission occurs in a definite orientation in relation to the whip-like structure called flagellum present at one end of the cell.

(C) In Plasmodium, the cell divides into many daughter cells simultaneously by multiple fission. Sometimes, during unfavourable conditions, a cyst or protective wall is formed around the cell and inside the cyst, the nucleus splits several times to form many daughter nuclei. This increases chances of their survival in favourable conditions.



Multiple fission in plasmodium

Fragmentation

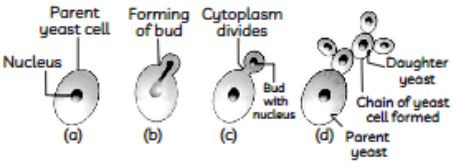
Fragmentation is the process of breaking off a piece of organism followed by mitotic cell division. Meiosis is not involved in this process as it is a mode of asexual reproduction. The broken part can develop into an independent adult.

Fragmentation process is limited to invertebrates, and it is absent in vertebrates. The ability of fragmentation depends on the complexity of the organism.

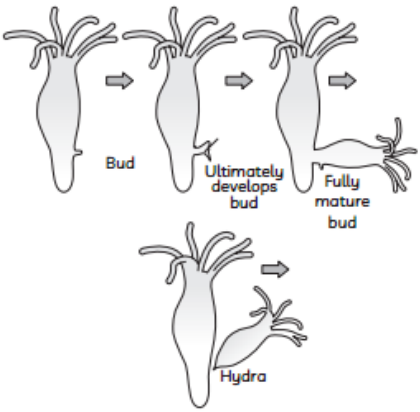
Budding

It takes place in multicellular organisms like hydra and yeast. A bulging or bud appears on the body as a result of repeated mitotic division.

Budding in Yeast: During budding in yeast, small daughter bud is formed on parent and continues to grow until it gets separated. The daughter cell is generally smaller in size as compared to parent.



Budding in Hydra: In hydra, the cell divides rapidly at a specific site and develops as an outgrowth called bud. These buds while attached to the parent part develop into small individual. When the small individual becomes large enough, it detaches itself from the parent body to exist as an independent individual.



Differences between Budding and Fission

S.No	Budding	Fission
(1)	The parent individual persists after the daughter individual has budded off.	The parent individual loses its identity after splitting into two or more daughter cells
(2)	Bud starts as a trace and slowly grows to an appropriate size before it pinches off but it is still smaller than the parent	The daughter individuals are identical in structure but all are smaller in size than the parent. Later they grow to attain their normal dimensions
(3)	Budding is rather slow and gradual	Fission is rapid and instantaneous

Spore Formation

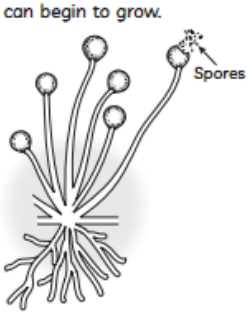
Spore formation is the most common method of asexual reprod uction in majority of fungi and bacteria like rhizopus, mucor, penicillium.

During spore formation, a structure called sporangium develops from the fungal hypha.

The nucleus divides several times within the sporangium, and each nucleus, with a bit of cytoplasm, develops into a spore.

The spores are liberated and they develop into new hypha after reaching the ground or substratum.

The spores are covered by thick walls that protect them until they come into contact with another moist surface and can begin to grow.



Regeneration

Regeneration is a modified form of fragmentation. It is known as a process that makes genomes, cells organs, organisms, and ecosystems resilient after disturbances or damage. Regeneration is carried out by specialized cells. From this mass of cells, different cells undergo changes in an organised sequence referred to as development to become various cell types and tissues.

Planarian flatworms are highly adapted with regeneration capabilities because of their asexual reproduction method. Star fishes also have the same ability to regenerate their arm, but unlike tailed amphibians and lizards, lost arms of star fishes could regenerate a complete new organism.

Difference between Fission and Fragmentation:

In fission, a unicellular organism breaks up to form two or more daughter organisms, whereas in fragmentation, a multicellular organism breaks up to form two or more daughter organisms.

Difference between Fragmentation and Regeneration

Fragmentation	Regeneration
Occurs in multi-cellular organisms with relatively simple body organisation.	Occurs in several fully differentiated organisms.
Organisms simply break up into smaller pieces upon maturation. These pieces or fragments grow into new individuals.	If the individual is accidently cut or broken up into many pieces, many of these pieces grow into separate individuals.
Fragmentation results in the production of identical offsprings.	In regeneration, the entire organism can regenerate as in certain animals like Planaria, but mostly the organism regenerates only a part of the body.
Example: Spirogyra	Example: Crabs can regenerate legs. Mammals can regenerate liver cells and blood cells. Lizards can regenerate their tail

Vegetative Propagation

Vegetative propogation is a method of reproduction in some higher plants in which a new plant develops from the vegetative parts of a plant such as root (as in dahlia, sweet potato), stem (as in ginger, potato, onion) or leaf (as in bryophyllum).

Advantages of vegetative propagation

(1) Plants raised by this method can bear flowers and fruits earlier than those produced from seeds.

(2) It is cheaper, easier and more rapid method of propagation in plants as compared to growing plants from their seeds.

(3) The traits or characters of the parent plant are preserved. That is, all plants produced are genetically similar enough to the parent plant to have all its characteristics.

(4) Better quality of the plants can be maintained.

(5) Those plants which do not produce viable seeds or seeds with prolonged period of dormancy, such as banana, orange, rose, jasmine, etc., can be propagated by this method.

Tissue Culture

New plants are grown by removing tissue or separating cells from the growing tip of a plant. The cells are then placed in an artificial medium where they divide rapidly to form a single group of cells or callus. The callus is transferred to another medium containing hormones for growth and differentiation. The plantlets are then placed in the soil so that they can grow into mature plants. It is commonly used for ornamental plants.

Advantages of tissue culture:

(1) It is a very fast technique. Thousands of plantlets can be produced in a few weeks time from a small amount of plant tissue.

(2) Many plants can be grown from one parent in disease-free conditions.

(3) It can grow plants round the year, irrespective of weather or season.

MOST LIKELY Questions

Short Answer Type-I Questions (SA-I)

[2 marks]

2. List any two benefits to an organism that reproduces through spores.

Ans. Benefits to an organism that reproduces through spores:

(1) Spores are covered by thick walls which enables them to survive under unfavourable conditions.

(2) By surviving under adverse conditions, the spores make these plants live forever.

3. What is a clone? Why do offspring formed by asexual reproduction exhibit remarkable similarity?

Ans. The new organisms or offsprings produced by one parent through asexual reproduction are called clones. The clones possess exact copies of the DNA or genes of their parents and hence show remarkable similarity to the parent or one another. Asexual reproduction does not involve gamete formation by meiosis and fertilization of male and female gametes; the offspring are genetically similar to the single parent.

4. Tissue culture is a type of asexual reproduction. Justify.

Ans. Tissue culture is a type of asexual reproduction as many plants can be grown from one parent and all the plants are also identical.

Short Answer Type-II Questions (SA-II)

[3 marks]

5. A student is given a permanent slide showing binary fission in Amoeba. Write two steps to focus the slide under microscope. Draw diagram and label the parts.

Ans. Steps to focus the slide under microscope:

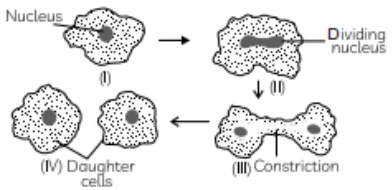
(1) Move the stage down to its lowest position.

(2) Place the glass slide onto the stage.

(3) Select the lowest power objective lens.

(4) Turn the focus know slowly until the cells are not seen.

(5) There is a proper management of light.



Binary fission in Amoeba

6. Name the type of asexual reproduction in which two individuals are formed from a single parent and the parental identity is lost. Write the first step from where such a type of reproduction begins. Draw first two stages of this reproduction.

Ans. Binary Fission is the type of asexual reproduction in which two individuals are formed from a single parent and the parental identity is lost.

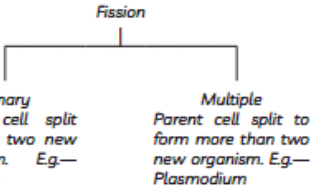
The first step in binary fission is elongation and subsequent division of nucleus into two nuclei *i.e.*, nuclear division.

In Binary Fission the identity of parental cell is lost. After fission parental cell called as daughter cell. The process starts with elongation of nucleus.

The first two stages of binary fission in amoeba are shown below:

Related Theory

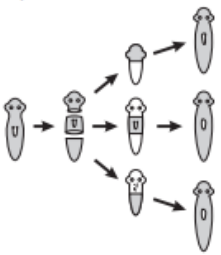
➥ ***Fission:*** *It is a type of asexual reproduction in which a single parent cell divide into two or more daughter cell.*



Case Based Question

[4 marks]

7. *Fragmentation and regeneration are two different modes of reproduction. During fragmentation an organism on maturation splits which enables the creation of new individuals from the fragments. While, regeneration occurs where the organism has an ability to regrow certain parts of its body when it loses them. In some organisms, only certain specialized cells, proliferate making regeneration possible.*



(A) Identify the organism and process shown in the figure

(B) Do you think humans can reproduce by the fragmentation mode?

(C) Do you think regeneration is same as reproduction? Justify your answer.

Ans. (A) The organims is *Planaria* and the process shown in the figure is regeneration in *Planaria*.

(B) Humans cannot simply divide cell-by-cell. The reason is that many multi-cellular organisms, as we have seen, are not simply a random collection of cells. Specialised cells are organised as tissues, and tissues are organised into organs, which then have to be placed at definite positions in the body. In such a carefully organised situation, cell-by-cell division would be impractical.

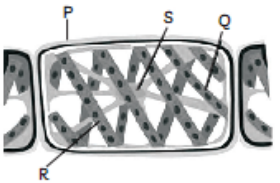
(C) Regeneration is not the same as reproduction since most organisms would not normally depend on being cut up to be able to reproduce.

Also, in certain organisms, only a portion of the organism is regenerated, rather than the entire organism (Example, tail of a lizard can be regenerated). Reproduction, on the other hand, entails the creation of a completely new creature. As a result, we can distinguish between regeneration and reproduction.

8. *Observe a permanent slide of amoeba under a microscope. Similarly observe another permanent slide of amoeba showing binary fission. Now, compare the observations of both the slides. Next, collect water from a lake or pond that appears dark green and contains filamentous structures. Put one or two filaments on a slide. Put a drop of glycerine on these filaments and cover it with a coverslip. Observe the slide under a microscope.*

(A) What do you observe on a permanent slide showing amoeba cell and another slide showing binary fission in amoeba?

(B) A student labelled the parts and noted their functions after observing the filaments taken from a pond under a microscope.

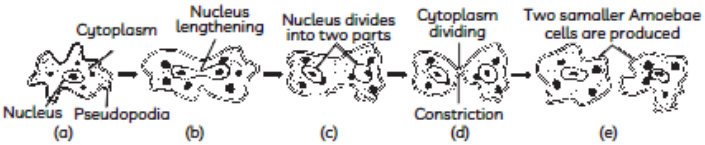


Identify part Q and write its function.

(C) (i) Name the type of reproduction in which parental identity is lost.

(ii) Which part represents nucleus and chloroplast in the figure?

Ans. (A) In the permanent slide of amoeba, an amoeba cell is seen containing normal cytoplasm and nucleus. In permanent slide showing binary fission, nucleus seen to be dividing and the constriction is also seen in cytoplasm.



(B) Q is pyrenoid and it stores starch and protein.

(C) (i) Fission

(ii) Part S represents nucleus and part R represents chloroplast.

TOPIC 4

SEXUAL REPRODUCTION

Sexual reproduction is a type of reproduction in which the two sexes, namely, male and female are involved. It incorporates a process of combining DNA from two different individuals during reproduction.

DNA Content Re-establishment in New Generation

(1) The gametes (or reproductive cells) contain only half the number of DNA (or half the number of chromosomes) as compared to the normal body cells.

(2) The germ cell that is large and contains the food stores is called the female gamete.

(3) The gamete that is smaller and motile is called the male gamete.

(4) When a male gamete combines with a female gamete during sexual reproduction, the zygote formed will have the same number of DNA as present in the organism.

Significance of Sexual Reproduction

(1) It promotes diversity of characters in the offsprings.

(2) It leads to variations which is necessary for evolution.

(3) It plays an important role in the origin of new species.

Sexual Reproduction in Plants

(1) The reproductive parts of angiosperms are located in the flower.

(2) Stamens and carpels are the reproductive parts of a flower which contain the germ cells.

(3) Stamen is the male reproductive part and produces pollen grains.

(4) Carpel is the female reproductive part and contains the ovary, style and stigma.

(5) Some flowers are unisexual such as papaya and watermelon while some are bisexual such as hibiscus and mustard.

(6) Unisexual flowers contain either stamens or carpels.

(7) Bisexual flowers contain both stamens and carpels. Majority of the flowers are bisexual.

(8) The various parts of a flower are:

- **Sepals:** These are usually green in colour.
- **Petals:** These are coloured.
- **Stamen:** It is the male reproductive part of a flower and consists of a stalk called filament and a flattened top called the anther. The anthers produce the pollen grains. Each pollen grain produces two male gametes.
- **Carpel:** It is the female reproductive part of a flower and consists of a swollen ovary at the base, an elongated middle style and a terminal stigma. The ovary contains ovules and each ovule has an egg.

Pollination

The transfer of pollen grains from anther to stigma is called pollination. The transfer of pollen grains is carried out by several agents such as water, wind, insects and other agencies.

Pollination is of two types–self pollination and cross pollination.

S. No.	Self Pollination	Cross Pollination
(1)	The transfer of pollen grains from the anther of a flower to the stigma of the same flower or another flower of the same plant.	The transfer of pollen grains from the anther of a flower to the stigma of another flower of a different plant of the same species.
(2)	It occurs in flowers which are genetically same.	It occurs between flowers which may be genetically different.
(3)	Self-pollination increases genetic uniformity and decreases variations.	Cross-pollination decreases genetic uniformity and increases variations.
(4)	Does not require pollinators for transfer of pollen grains.	Requires pollinators for transfer of pollen grains.

Fertilization in Plants

(1) Pollination, i.e., transfer of pollen grains from anther of a flower to stigma takes place.

(2) Pollen grains which are deposited on the stigma form tubes called pollen tubes.

(3) One pollen tube grows through the style and reaches the ovary where the ovules are located.

(4) The pollen tube normally enters the ovule through a small opening called micropyle.

(5) Inside the ovule, the pollen tube releases two male gametes into the embryo sac which contains the egg.

S. No.	Pollination	Fertilization
(1)	Pollination is a process of transferring of pollens from stamen to the stigma of a flower.	Fertilization is the fusion of male gametes and female gametes of plants
(2)	It precedes fertilization	It takes place only after pollination has taken place.

Double fertilization: Inside each embryoac, two fusions, syngamy and triple fusion take place and this mechanism of two fusions occurring in an embryo sacis called double fertilization.

Syngamy: The fusion of one male gamete with the female gamete (egg) inside the embryoac is called syngamy and it results in zygote.

(1) After fertilization, the zygote divides several times to form an embryo within the ovule.

(2) The ovule develops a tough coat and is gradually converted into a seed.

Germination

The process by which the seed, which contains the future plant or embryo, develops into a seedling under appropriate conditions.

(1) The ovary grows rapidly and ripens to form a fruit.

(2) The petals, sepals, stamens, style and stigma shrivel and fall off.

Human Reproductive System

The structures associated with reproduction are different in males and females.

Puberty

Puberty is the age in the life of human beings when the reproductive tissues begin to mature and the reproductive system becomes functional. It is 13 to 14 years for males and 10 to 12 years for females. Some changes begin to take place in both girls and boys during this period.

(1) Changes such as thicker hair in armpits and genital area between the thighs, thinner hair on legs and arms, oily skin and development of pimples are common to both girls and boys.

(2) However, there are also changes that are different between boys and girls. For example, increase in breast size, darkening of the skin of the nipples and beginning of menstruation are some of the changes observed in girls. Thick hair growth on the face, cracking of voice, and penis occasionally getting erect and enlarged are some of the changes observed in boys.

Role of Hormones: The testes and ovaries produce viable gametes and also secrete hormones.

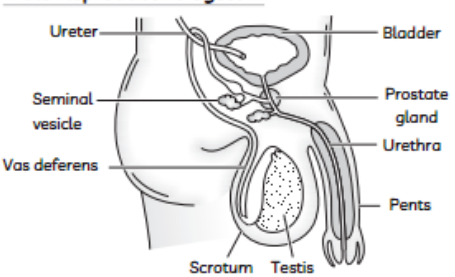
(1) The testis secretes the male hormone testosterone and the ovary secretes the female hormone estrogen.

(2) Hormones regulate the process of gametogenesis (formation of gametes).

(3) Hormones maintain the structure and function of accessory sex organs

(4) Hormones develop secondary sex characters like facial, axial and pubic hair, pitch of the voice and development of mammary glands.

Male Reproductive System



The human male reproductive system consists of the following organs:

(1) Testes: The primary male reproductive organ is a pair of testis which lies in a sac-like muscular structure outside the abdominal cavity called scrotum. The formation of germ-cells or sperms takes place in the testes. It secretes the male hormone testosterone, which regulates the formation of sperms and brings about changes in appearance in boys.

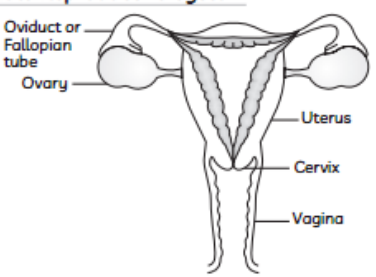
(2) Scrotum: It provides an optimal temperature for formation of sperms which is 1– 3^0 C lower than the body temperature.

(3) Vas deferens: It is a long tube which arises from each testes and which carries sperms into organs called seminal vesicles, where the sperms get nourished and stored.

(4) Urethra: It is a common passage for the passage of both urine and spermatic fluid. The vas deferens unites with a duct coming from the urinary bladder to form urethra.

(5) Penis: It forms the external male genital organ and is a thick muscular organ which encloses the urethra. There is only one opening for the urine and sperms.

Female Reproductive System



The human female reproductive consists of the following organs:

(1) Ovaries: There is a pair of small and oval-shaped organs, located in the abdominal cavity near the kidney. Ovaries are the female primary reproductive organs which perform dual functions of production of female gamete or ovum and the secretion of female sex hormones, estrogen and progesterone. Each ovary is composed of ovarian follicles and these follicles undergo maturation at puberty to produce ova.

(2) Fallopian tube or Oviduct: These are a pair of long convoluted tubes that carry ova or eggs from the ovary to the uterus. The fallopian tube has a funnel-shaped opening near the ovary. These tubes from both the sides open into a muscular structure, the uterus.

(3) Uterus or womb: It is a hollow, pear-shaped organ within which the embryo develops. Its upper por-

tion is broader, while its lower portion is narrower, called cervix.

(4) **Vagina:** The cervix opens into the vagina which is a tubular structure and also called "birth canal". Vagina receives sperms from the male and also serves as the passage through which the fully developed foetus is born.

Sexual cycle in females: When the human females attain the age of puberty, the ovaries exhibit a cycle of events at definite intervals which are described below:

(1) The ovarian follicle grows into mature follicle.

(2) One mature follicle develops to surround one ovum.

(3) The maturing ovum is from one of the two ovaries.

(4) **Ovulation:** The ovum is then released from the respective ovary by the process called ovulation.

(5) As the ovarian follicles mature, the inner wall of uterus thickens to get prepared for receiving the developing zygote in case fertilization occurs.

(6) In case fertilization does not take place, the thickened inner wall of the uterus breaks down along with its blood vessels and moves out of the vagina in the form of bleeding, called menstrual flow which lasts for 4 – 7 days.

(7) **Menstrual Cycle:** The cycle of events taking place in the ovaries and uterus every twenty eight days and marked by the menstrual flow is called menstrual cycle or sexual cycle in human female.

(8) Menstruation occurs every 28 to 30 days and ovulation takes place in the mid of the menstrual cycle around 14th day.

(9) Both ovulation and menstruation stops temporarily when the women gets pregnant till birth of the offspring.

(10) **Menarche:** The commencement of menstruation at puberty is called menarche and marks the beginning of reproductive life of a woman.

(11) **Menopause:** The stoppage of menstrual flow and other events around the age of 50 years in human females is called menopause.

Fertilization

(1) The fertilization in human beings is internal.

(2) It takes place if copulation has taken place during ovulatory period, i.e., the middle of the menstrual cycle.

(3) It takes place in the fallopian tube where only one sperm out of the millions of sperms released in the vagina fertilizes the ovum.

(4) Fertilization is marked by the absence of menstrual flow.

(5) Zygote is formed after the union of the sperm and the ovum.

(6) This marks the beginning of pregnancy, *i.e.*, the embryonic development of zygote starts in the fallopian tube.

(7) **Implantation:** After fertilization has taken place, the embryo moves down to reach the uterus and gets attached to its thickened wall and this close attachment of the embryo with the uterus is called implantation.

(8) **Placenta:** It is a special tissue which develops between uterine wall and the embryo after implantation and through which the development needs of the foetus are met from the mother's body. This is a disc which is embedded in the uterine wall. It contains villi on the embryo's side of the tissue and blood spaces surrounding the villi on the mother's side. This provides a large surface area for glucose and oxygen to pass from the mother to the embryo. The waste substances generated by the developing embryo is also removed through the placenta.

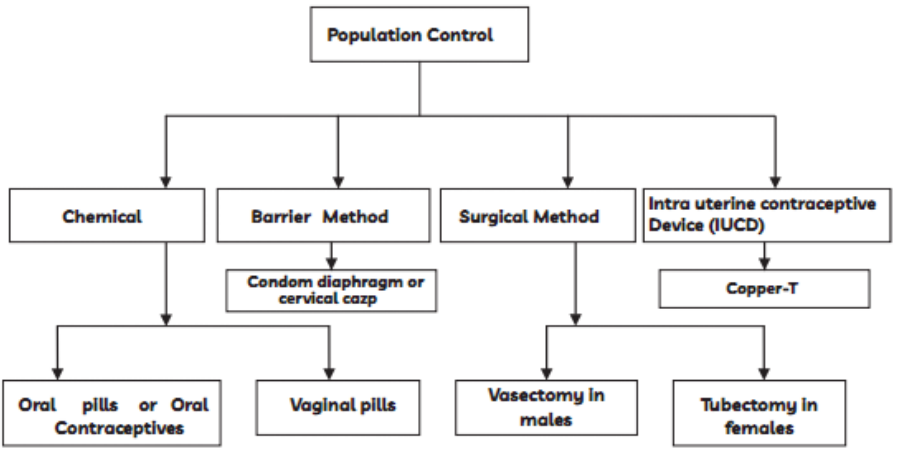
Reproductive Health

Reproductive health is important as the process of sexual maturation is gradual and making choices can become very diffcult due to pressures from friends, family or government agencies. Also, many diseases can be transmitted sexually as the sexual act is a very intimate connection of bodies.

Sexually Transmitted Diseases (STDs): These are the diseases that are spread from an infected person to a healthy person by sexual contact. These include bacterial infections such as gonorrhoea and syphilis, and viral infections such as warts and HIV-AIDS.

Population Control

A number of techniques have been developed to prevent and manage pregnancy as frequent pregnancies have an adverse effect on the health of a woman. These methods are described below:



Barrier Method	Chemical Method	Surgical Method
Physical devices such as condom, diaphragm and cervical caps which prevent the entry of sperm in the female genital tract during copulation are used.	Specific drugs are used by females which are of two types-Qral pills and vaginal pills. Oral pills are hormonal preparations that inhibit the production of gametes by the action on hypothalamus, pituitary and the ovaries. IUCDs (Intrauterine Contraceptive Devices) prevent implantation in the uterus. A copper-T is placed safely inside the uterus.	A small protion of vas deferens in males and the fallopian tube in females is surgically removed or ligated (tied). It is called vasectomy in males and tubectomy in females.

Effects of contraceptives:

(1) Since oral pills change the hormonal balance of the body so that eggs are not released and fertilization does not occur and hence can cause side-effects.

(2) Loop or copper-T are placed in the uterus to prevent pregnancy and can cause irritation of the uterus.

(3) Surgical methods are safe in the long run but they can cause infections and other problems if not performed properly.

Advantages of adopting contraceptive methods :

(1) Avoiding frequent and unwanted pregnancy

(2) Keeping population and hence birth rate under control

(3) Helps in keeping proper gap between two pregnancies.

(4) Helps in preventing the spread of sexually transmitted diseases.

(5) Helps in improving the reproductive health of women.

Female Foeticide: Surgical methods can be used for removal of unwanted pregnancies and hence can be misused by people who do not want a particular child. Female foeticide is the illegal sex-selective abortion of female foetuses due to which child sex ratio is declining at an alarming rate.

MOST LIKELY Questions

Short Answer Type-I Questions (SA-I)

[2 marks]

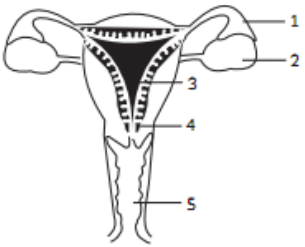
9. Give two reasons for the appearance of variations among the progeny formed by sexual reproduction.

Ans. Progeny formed as a result of sexual reproduction shows variations because:

(1) Sexual reproduction involves combining of DNA from two different individuals.

(2) The gene combination is different in gametes. The genetic material is exchanged between chromosomes before the formation of zygote, i.e., deoxyri-bonucleic acid (DNA) exchange in the chromosome. The combination of two sets of chromosomes, one set from each parent during zygote formation, leads to variation within a species.

10. Identify the given diagram. Name the parts 1 to 5



Ans. The given diagram is the human female reproductive system.

Name of parts are given as follow:

1- Fallopian tube/Oviduct
2- Ovary
3- Uterus
4- Cervix
5- Vagina

Short Answer Type-II Questions (SA-II)

[3 marks]

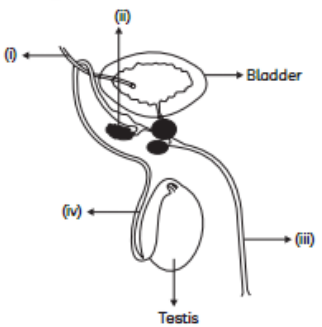
11. In a tobacco plant, the male gametes have 24 chromosomes. What is the number of chromosomes in the female gamete? What is the number of chromosomes in the zygote?

Ans. Male and female gametes of a species have the same number of chromosomes. Hence, the number of chromosome in the female gamete of tobacco plants is 24. Zygote is formed by the fusion of male and female gametes, so it will have 48 chromosomes.

The number of chromosomes in the female gamete is 24.

The number of chromosomes in zygote is 48.

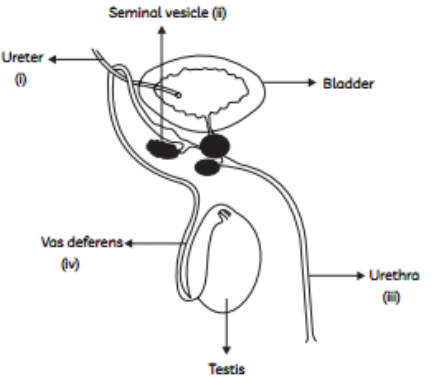
12. Based on the given diagram answer the questions given below:



(A) Name the hormone secreted by testis and mention its role.

(B) State the functions of (ii) and (iii) in the process of reproduction.

Ans.



(A) Hormone secreted by testis: Testosterone Role of testosterone: It brings about changes in appearance seen in boys at the time of puberty (secondary sexual characteristics).

(B) Functions of ii (Seminal vesicle): Along the path of vas deferens, seminal vesicle along with prostrate gland and their secretions which make the transport of sperms easier and this fluid provides nutrition to sperms.

13. Why do multicellular organisms use complex way of reproduction?

Ans. Multicellular organisms cannot reproduce by cell because they are not simple random collection of cells.

In them, specialized cells are organized as tissues which are organized into organs. Cell-by-cell division would be impractical. Multicellular organisms, therefore, require to use more complex ways of reproduction.

Case Based Questions

[4 marks]

14. *The reproductive parts of angiosperms are located in the flower. The different parts of a flower are sepals, petals, stamens and carpels. Stamens and carpels are the reproductive parts of a flower which contain the germ-cells.*

The flower may be unisexual (papaya, watermelon) when it contains either stamens or carpels or bisexual (Hibiscus, mustard) when it contains both stamens and carpels. Stamen is the male reproductive part and it produces pollen grains that are yellowish in colour. Carpel is present in the centre of a flower and is the female reproductive part.

(A) Where are the plant's sex organs located?

(B) What is the function of a flower?

(C) (i) Where is the male and female gametes formed in flowering plants?

(ii) What changes take place in the flower after fertilisation which lead to the formation of seeds and fruit?

Ans. (A) Plant's sex organs are located in the flower.

(B) The function of a flower is to produce male and female gametes and to ensure that fertilisation will takes place to make new seeds for the reproduction of plant.

(C) (i) The male gamete is formed in the anther of a flower and female gamete is formed in ovary of a flower.

(ii) The fertilised egg divides several times to form an embryo within the ovule which develops a tough coat around it and is gradually converted into a seed. The ovary of the flower develops and becomes a fruit with seeds inside it.

15. *Pre-Conception and Pre-Natal Diagnostic Techniques (PCPNDT) Act, 1994 is an Act of the Parliament of India enacted to stop female foeticides and arrest the declining sex ratio in India. The act banned prenatal sex determination. This process began in the early 1990 when ultrasound techniques gained widespread use in India. There was a tendency for families to continuously produce children until a male child was born. Social discrimination against women and a preference for sons have promoted female foeticide in various forms skewing the sex ratio of the country towards men.*

(A) Why is child sex-ratio declining at an alarming rate in India?

(B) How can unwanted pregnancies be terminated?

(C) (i) What is contraception?

(ii) Write names of any two contraceptive methods.

Ans. (A) The child-sex ratio is declining at an alarming rate because of preference in Indian societies for a male child and reckless female foeticides.

(B) Unwanted pregnancies can be terminated by surgery.

(C) (i) The male gemate is formed in the anther of a flower and female gamete is formed in ovary of a flower.

(ii) Methods of contraception:

(1) Mechanical barrier methods such as use of condom

(2) Surgical method such as tubectomy in females and vasectomy in males

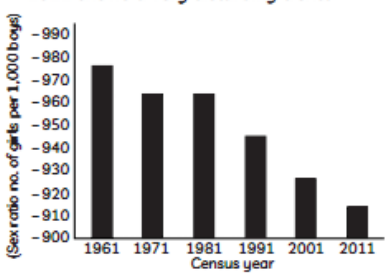
(3) Chemical such as Oral and vaginal pills

(4) Intra Uterine Contraceptive Devices such as copper –T

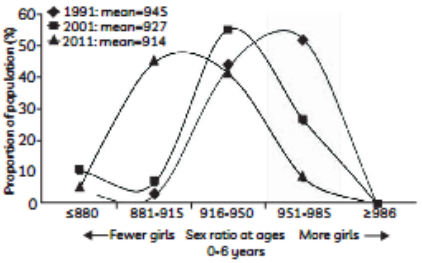
(Write any two points to get full marks)

16. *Family planning is about deciding how many children you choose to have and when you want to have them (timing of pregnancies and birth spacing). Spacing births allows the mother to recover physically and emotionally before she gets pregnant again, and faces the demands of pregnancy, birth and breast feeding. STIs including HIV/AIDS can also be prevented with correct and consistent use of condoms. Younger women (adolescents) can delay pregnancy until their bodies are mature and they are ready in terms of their life course. Older women (over 35) can prevent unwanted pregnancies that are often risky for their health and can lead to complications for both mothers and infants.*

India's 2011 census revealed a growing imbalance between the numbers of girls and boys aged 0–6 years, which may be due to increased prenatal sex determination with subsequent selective abortion of female fetuses. The sex ratio from the years 1961 to 2011 shows a very disturbing trend.



Distribution of the total population living in states with varying child sex ratios (girls per 1000 boys at ages 0—6 years), 1991, 2001, and 2011 is shown below.



(A) What is the main reason for the sex ratio as seen in the graph?

(B) Which surgical method is adopted for avoiding pregnancies in females?

(C) (i) The use of which contraceptive methods can prevent sexually transmitted diseases ?

(ii) Name a sexually transmitted disease and it's cause.

Ans. (A) Female foeticide is the illegal sex-selective abortion of female foetuses due to which child sex ratio is declining at an alarming rate.

(B) Blocking fallopian tube in females (known as tubectomy).

(C) (i) As condoms are the only contraceptives that create a mechanical barrier between the partners sex organs during sexual intercourse, they can prevent sexually transmitted disesases.

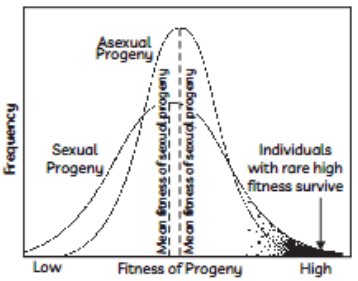
(ii) Sexually Transmitted Disease: warts, cause : Virus

Warts is a sexually transmitted disease which is caused due to Human Papilloma Virus.

17. *Paramecia can reproduce either asexually or sexually, depending on their environmental conditions. Most of the time, paramecia reproduce asexually by splitting one cell into two cells, a process called "Binary Fission". Binary fission takes place when ample nutrients are available. Under favorable conditions, they may divide two or three times a day. The size of the paramecia population can grow rapidly by the binary fission.*

Sexual reproduction of paramecia takes place under conditions of starvation. There are two mating types for paramecia, which are referred to as odd and even. Odd types can only mate with the even types, but the same mating types can not mate with each other. Moreover, only cells within a single paramecium species can mate with one another.

The graph below shows a comparison between sexual and asexual modes of reproduction.



(A) Why paramecium decides for sexual reproduction?

(B) What kind of division occurs during asexual and sexual modes of reproduction?

(C) Justify the following statements:

(i) The mean fitness of asexual progeny is adapted optimally for a particularly narrow niche.

(ii) Sexual progeny have a higher chance of survival when niche changes.

Ans. (A) The reason why the paramecia decide to sexual reproduction is that they need to create "genetic variations" to increase their chance of survival under a harsh condition. On the other hand, the daughter cells generated from binary fission have identical genome like their parent cell. We call them "clones".

(B) Asexual Reproduction requires only mitotic cell division as no gametes are produced. Sexual reproduction requires meiotic division followed by mitotic division as first gametes are formed and then their fusion takes place.

(C) (i) The mean fitness of an asexual clone of organisms is adapted optimally for a particularly narrow niche. They are perfect in the current environment, but, once the condition changes, the entire population may suddenly become extinct.

(ii) Sexual reproduction can produce a wider range of sub-optimally adapted types. Some may not be able to survive under the current environment (an example is the genetic diseases in humans). However, an ecological disaster that eliminates the asexual progeny will not have as severe an impact on the sexual progeny, because of the diversity of genotypes.