

CHAPTER 1

REPRODUCTION IN ORGANISMS

MULTIPLE-CHOICE QUESTIONS

1. A few statements describing certain features of reproduction are given below:
- Gametic fusion takes place
 - Transfer of genetic material takes place
 - Reduction division takes place
 - Progeny have some resemblance with parents

Select the options that are true for both asexual and sexual reproduction from the options given below:

(a) i and ii; (b) ii and iii; (c) ii and iv; (d) i and iii.

2. The term 'clone' cannot be applied to offspring formed by sexual reproduction because:
- Offspring do not possess exact copies of parental DNA
 - DNA of only one parent is copied and passed on to the offspring
 - Offspring are formed at different times
 - DNA of parent and offspring are completely different.

3. Asexual method of reproduction by binary fission is common to which of the following?
- Some eukaryotes
 - All eukaryotes
 - Some prokaryotes
 - All prokaryotes

Choose the correct option from the following:

(a) i and ii; (b) ii and iii; (c) i and iii; (d) iii and iv.

4. A few statements with regard to sexual reproduction are given below:
- Sexual reproduction does not always require two individuals
 - Sexual reproduction generally involves gametic fusion
 - Meiosis never occurs during sexual reproduction
 - External fertilisation is a rule during sexual reproduction

Choose the correct statements from the options below:

(a) i and iv (b) i and ii (c) ii and iii (d) i and iv

5. A multicellular, filamentous alga exhibits a type of sexual life cycle in which the meiotic division occurs after the formation of zygote. The adult filament of this alga has
- haploid vegetative cells and diploid gametangia
 - diploid vegetative cells and diploid gametangia
 - diploid vegetative cells and haploid gametangia
 - haploid vegetative cells and haploid gametangia.
6. The male gametes of rice plant have 12 chromosomes in their nucleus. The chromosome number in the female gamete, zygote and the cells of the seedling will be, respectively,
- 12, 24, 12
 - 24, 12, 12
 - 12, 24, 24
 - 24, 12, 24.
7. Given below are a few statements related to external fertilization. Choose the correct statements.
- The male and female gametes are formed and released simultaneously
 - Only a few gametes are released into the medium
 - Water is the medium in a majority of organisms exhibiting external fertilization
 - Offspring formed as a result of external fertilization have better chance of survival than those formed inside an organism
- (a) iii and iv (b) i and iii (c) ii and iv (d) i and iv
8. The statements given below describe certain features that are observed in the pistil of flowers.
- Pistil may produce more than one seed
 - Each carpel may have more than one ovule
 - Each carpel has only one ovule
 - Pistil have only one carpel
- Choose the statements that are true from the options below:
- (a) i and ii (b) i and iii (c) ii and iv (d) iii and iv
9. Which of the following situations correctly describe the similarity between an angiosperm egg and a human egg?
- Eggs of both are formed only once in a lifetime
 - Both the angiosperm egg and human egg are stationary

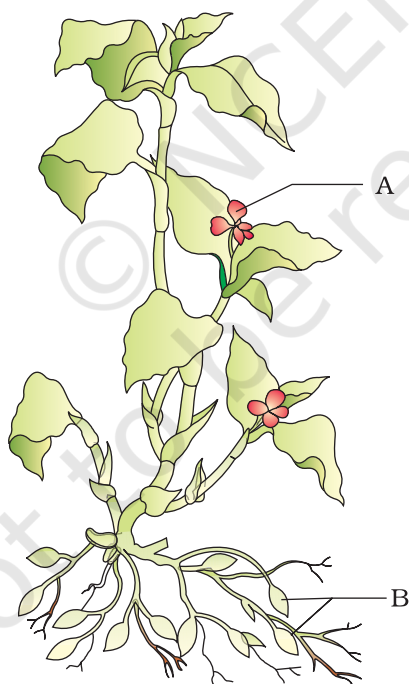
- iii. Both the angiosperm egg and human egg are mobile
 - iv. Syngamy in both results in the formation of zygote
- Choose the correct answer from the options given below:
- (a) ii and iv (b) iv only (c) iii and iv (d) i and iv
10. Appearance of vegetative propagules from the nodes of plants such as sugarcane and ginger is mainly because:
- a. Nodes are shorter than internodes
 - b. Nodes have meristematic cells
 - c. Nodes are located near the soil
 - d. Nodes have non-photosynthetic cells
11. Which of the following statements, support the view that elaborate sexual reproductive process appeared much later in the organic evolution.
- i. Lower groups of organisms have simpler body design
 - ii. Asexual reproduction is common in lower groups
 - iii. Asexual reproduction is common in higher groups of organisms
 - iv. The high incidence of sexual reproduction in angiosperms and vertebrates
- Choose the correct answer from the options given below:
- (a) i, ii and iii; (b) i, iii and iv (c) i, ii and iv (d) ii, iii and iv
12. Offspring formed by sexual reproduction exhibit more variation than those formed by Asexual reproduction because:
- a. Sexual reproduction is a lengthy process
 - b. Gametes of parents have qualitatively different genetic composition
 - c. Genetic material comes from parents of two different species
 - d. Greater amount of DNA is involved in sexual reproduction.
13. Choose the correct statement from amongst the following:
- a. Dioecious (hermaphrodite) organisms are seen only in animals
 - b. Dioecious organisms are seen only in plants
 - c. Dioecious organisms are seen in both plants and animals
 - d. Dioecious organisms are seen only in vertebrates
14. There is no natural death in single celled organisms like *Amoeba* and bacteria because:
- a. They cannot reproduce sexually
 - b. They reproduce by binary fission
 - c. Parental body is distributed among the offspring
 - d. They are microscopic

15. There are various types of reproduction. The type of reproduction adopted by an organism depends on:
- The habitat and morphology of the organism
 - Morphology of the organism
 - Morphology and physiology of the organism
 - The organism's habitat, physiology and genetic makeup
16. Identify the incorrect statement.
- In asexual reproduction, the offspring produced are morphologically and genetically identical to the parent
 - Zoospores are sexual reproductive structures
 - In asexual reproduction, a single parent produces offspring with or without the formation of gametes
 - Conidia are asexual structures in *Penicillium*
17. Which of the following is a post-fertilisation event in flowering plants?
- Transfer of pollen grains
 - Embryo development
 - Formation of flower
 - Formation of pollen grains
18. The number of chromosomes in the shoot tip cells of a maize plant is 20. The number of chromosomes in the microspore mother cells of the same plant shall be:
- 20
 - 10
 - 40
 - 15

VERY SHORT ANSWER TYPE QUESTIONS

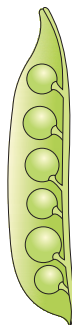
- Mention two inherent characteristics of *Amoeba* and yeast that enable them to reproduce asexually.
- Why do we refer to offspring formed by asexual method of reproduction as clones?
- Although potato tuber is an underground part, it is considered as a stem. Give two reasons.

4. Between an annual and a perennial plant, which one has a shorter juvenile phase? Give one reason.
5. Rearrange the following events of sexual reproduction in the sequence in which they occur in a flowering plant:
embryogenesis, fertilisation, gametogenesis, pollination.
6. The probability of fruit set in a self-pollinated bisexual flower of a plant is far greater than a dioecious plant. Explain.
7. Is the presence of large number of chromosomes in an organism a hindrance to sexual reproduction? Justify your answer by giving suitable reasons.
8. Is there a relationship between the size of an organism and its life span? Give two examples in support of your answer.
9. In the figure given below the plant bears two different types of flowers marked 'A' and 'B'. Identify the types of flowers and state the type of pollination that will occur in them.



10. Give reasons as to why cell division cannot be a type of reproduction in multicellular organisms.

11. In the figure given below, mark the ovule and pericarp.



12. Why do gametes produced in large numbers in organisms exhibit external fertilisation?
13. Which of the followings are monoecious and dioecious organisms.
- Earthworm _____
 - Chara* _____
 - Marchantia* _____
 - Cockroach _____
14. Match the organisms given in Column-'A' with the vegetative propagules given in column 'B'.
- | Col. A | Col. B |
|--------------------|---------------|
| i. Bryophyllum | a) offset |
| ii. Agave | b) eyes |
| iii. Potato | c) leaf buds |
| iv. Water hyacinth | d) bulbils |
15. What do the following parts of a flower develop into after fertilisation?
- Ovary _____
 - Ovules _____

SHORT ANSWER TYPE QUESTIONS

- In haploid organisms that undergo sexual reproduction, name the stage in the life cycle when meiosis occurs. Give reasons for your answer.
- The number of taxa exhibiting asexual reproduction is drastically reduced in higher plants (angiosperms) and higher animals (vertebrates) as compared with lower groups of plants and animals. Analyse the possible reasons for this situation.

3. Honeybees produce their young ones only by sexual reproduction. In spite of this, in a colony of bees we find both haploid and diploid individuals. Name the haploid and diploid individuals in the colony and analyse the reasons behind their formation.
4. With which type of reproduction do we associate the reduction division? Analyse the reasons for it.
5. Is it possible to consider vegetative propagation observed in certain plants like *Bryophyllum*, water hyacinth, ginger etc., as a type of asexual reproduction? Give two/three reasons.
6. 'Fertilisation is not an obligatory event for fruit production in certain plants'. Explain the statement.
7. In a developing embryo, analyse the consequences if cell divisions are not followed by cell differentiation.
8. List the changes observed in an angiosperm flower subsequent to pollination and fertilisation.
9. Suggest a possible explanation why the seeds in a pea pod are arranged in a row, whereas those in tomato are scattered in the juicy pulp.
10. Draw the sketches of a zoospore and a conidium. Mention two dissimilarities between them and at least one feature common to both structures.
11. Justify the statement 'Vegetative reproduction is also a type of asexual reproduction'.

LONG ANSWER TYPE QUESTIONS

1. Enumerate the differences between asexual and sexual reproduction. Describe the types of asexual reproduction exhibited by unicellular organisms.
2. Do all the gametes formed from a parent organism have the same genetic composition (identical DNA copies of the parental genome)? Analyse the situation with the background of gametogenesis and provide or give suitable explanation.
3. Although sexual reproduction is a long drawn, energy-intensive complex form of reproduction, many groups of organisms in Kingdom Animalia and Plantae prefer this mode of reproduction. Give at least three reasons for this.
4. Differentiate between (a) oestrus and menstrual cycles; (b) ovipary and vivipary. Cite an example for each type.

5. Rose plants produce large, attractive bisexual flowers but they seldom produce fruits. On the other hand a tomato plant produces plenty of fruits though they have small flowers. Analyse the reasons for failure of fruit formation in rose.

Both these plants - rose and tomato - both selected by human beings for different characteristics, the rose for its flower and tomato for its fruit. Roses, being vegetatively propagated do not need to produce seeds.

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CHAPTER 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS

MULTIPLE-CHOICE QUESTIONS

1. Among the terms listed below, those that are not technically correct names for a floral whorl are:
 - i. Androecium
 - ii. Carpel
 - iii. Corolla
 - iv. Sepal(a) i and iv, (b) iii and iv (c) ii and iv (d) i and ii.
2. Embryo sac is to ovule as _____ is to an anther.
 - a. Stamen
 - b. Filament
 - c. Pollen grain
 - d. Androecium
3. In a typical complete, bisexual and hypogynous flower the arrangement of floral whorls on the thalamus from the outermost to the innermost is:
 - a. Calyx, corolla, androecium and gynoecium
 - b. Calyx, corolla, gynoecium and androecium
 - c. Gynoecium, androecium, corolla and calyx
 - d. Androecium, gynoecium, corolla and calyx
4. A dicotyledonous plant bears flowers but never produces fruits and seeds. The most probable cause for the above situation is:
 - a. Plant is dioecious and bears only pistillate flowers
 - b. Plant is dioecious and bears both pistillate and staminate flowers
 - c. Plant is monoecious
 - d. Plant is dioecious and bears only staminate flowers.

5. The outermost and innermost wall layers of microsporangium in an anther are respectively:
 - a. Endothecium and tapetum
 - b. Epidermis and endodermis
 - c. Epidermis and middle layer
 - d. Epidermis and tapetum
6. During microsporogenesis, meiosis occurs in:
 - a. Endothecium
 - b. Microspore mother cells
 - c. Microspore tetrads
 - d. Pollen grains.
7. From among the sets of terms given below, identify those that are associated with the gynoecium.
 - a. Stigma, ovule, embryo sac, placenta
 - b. Thalamus, pistil, style, ovule
 - c. Ovule, ovary, embryo sac, tapetum
 - d. Ovule, stamen, ovary, embryo sac
8. Starting from the innermost part, the correct sequence of parts in an ovule are,
 - a. egg, nucellus, embryo sac, integument
 - b. egg, embryo sac, nucellus, integument
 - c. embryo sac, nucellus, integument, egg
 - d. egg, integument, embryo sac, nucellus.
9. From the statements given below choose the option that are true for a typical female gametophyte of a flowering plant:
 - i. It is 8-nucleate and 7-celled at maturity
 - ii. It is free-nuclear during the development
 - iii. It is situated inside the integument but outside the nucellus
 - iv. It has an egg apparatus situated at the chalazal end

(a) i and iv, (b) ii and iii (c) i and ii (d) ii and iv
10. Autogamy can occur in a chasmogamous flower if:
 - a. Pollen matures before maturity of ovule
 - b. Ovules mature before maturity of pollen
 - c. Both pollen and ovules mature simultaneously
 - d. Both anther and stigma are of equal lengths.

11. Choose the correct statement from the following:
 - a. Cleistogamous flowers always exhibit autogamy
 - b. Chasmogamous flowers always exhibit geitonogamy
 - c. Cleistogamous flowers exhibit both autogamy and geitonogamy
 - d. Chasmogamous flowers never exhibit autogamy
12. A particular species of plant produces light, non-sticky pollen in large numbers and its stigmas are long and feathery. These modifications facilitate pollination by:
 - a. Insects
 - b. Water
 - c. Wind
 - d. Animals.
13. From among the situations given below, choose the one that prevents both autogamy and geitonogamy.
 - a. Monoecious plant bearing unisexual flowers
 - b. Dioecious plant bearing only male or female flowers
 - c. Monoecious plant with bisexual flowers
 - d. Dioecious plant with bisexual flowers
14. In a fertilised embryo sac, the haploid, diploid and triploid structures are:
 - a. Synergid, zygote and primary endosperm nucleus
 - b. Synergid, antipodal and polar nuclei
 - c. Antipodal, synergid and primary endosperm nucleus
 - d. Synergid, polar nuclei and zygote.
15. In an embryo sac, the cells that degenerate after fertilisation are:
 - a. Synergids and primary endosperm cell
 - b. Synergids and antipodals
 - c. Antipodals and primary endosperm cell
 - d. Egg and antipodals.
16. While planning for an artificial hybridization programme involving dioecious plants, which of the following steps would not be relevant:
 - a. Bagging of female flower
 - b. Dusting of pollen on stigma
 - c. Emasculation
 - d. Collection of pollen

17. In the embryos of a typical dicot and a grass, true homologous structures are:
- Coleorrhiza and coleoptile
 - Coleoptile and scutellum
 - Cotyledons and scutellum
 - Hypocotyl and radicle.
18. The phenomenon observed in some plants wherein parts of the sexual apparatus is used for forming embryos without fertilisation is called:
- Parthenocarpy
 - Apomixis
 - Vegetative propagation
 - Sexual reproduction.
19. In a flower, if the megaspore mother cell forms megaspores without undergoing meiosis and if one of the megaspores develops into an embryo sac, its nuclei would be:
- Haploid
 - Diploid
 - A few haploid and a few diploid
 - With varying ploidy.
20. The phenomenon wherein, the ovary develops into a fruit without fertilisation is called:
- Parthenocarpy
 - Apomixis
 - Asexual reproduction
 - Sexual reproduction

VERY SHORT ANSWER TYPE QUESTIONS

- Name the component cells of the 'egg apparatus' in an embryo sac.
- Name the part of gynoecium that determines the compatible nature of pollen grain.
- Name the common function that cotyledons and nucellus perform.
- Complete the following flow chart

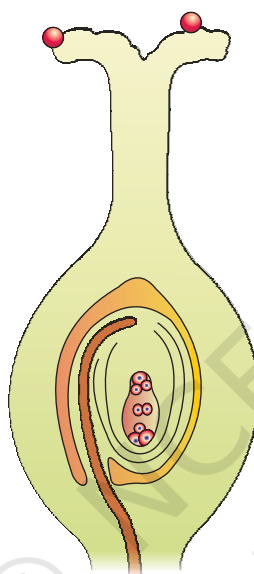
Pollen mother cell → Pollen tetrad → Pollen grain

↗ Vegetative cell
↘ -----

5. Indicate the stages where meiosis and mitosis occur (1, 2 or 3) in the flow chart.

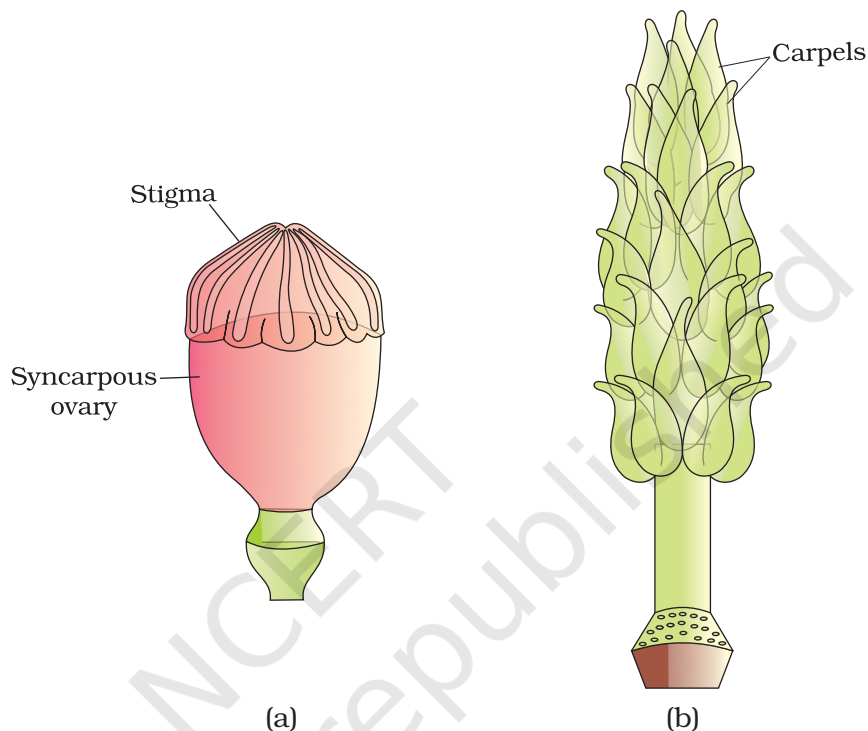
Megaspore mother cell $\xrightarrow{1}$ Megaspores $\xrightarrow{2}$ Embryo sac $\xrightarrow{3}$ Egg

6. In the diagram given below, show the path of a pollen tube from the pollen on the stigma into the embryo sac. Name the components of egg apparatus.



7. Name the parts of pistil which develop into fruit and seeds.
8. In case of polyembryony, if an embryo develops from the synergid and another from the nucellus which is haploid and which is diploid?
9. Can an unfertilised, apomictic embryo sac give rise to a diploid embryo? If yes, then how?
10. Which are the three cells found in a pollen grain when it is shed at the three celled stage?
11. What is self-incompatibility?
12. Name the type of pollination in self-incompatible plants.
13. Draw the diagram of a mature embryo sac and show its 8-nucleate, 7-celled nature. Show the following parts: antipodals, synergids, egg, central cell, polar nuclei.

14. Which is the triploid tissue in a fertilised ovule? How is the triploid condition achieved?
15. Are pollination and fertilisation necessary in apomixis? Give reasons.
16. Identify the type of carpel with the help of diagrams given below:

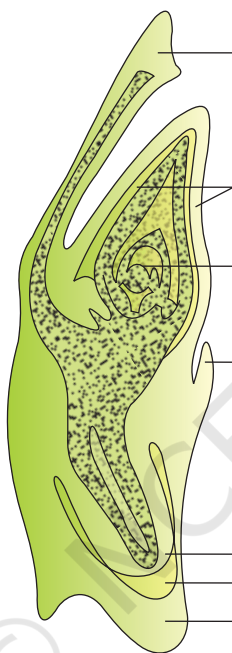


17. How is pollination carried out in water plants?
18. What is the function of the two male gametes produced by each pollen grain in angiosperms.

SHORT ANSWER TYPE QUESTIONS

1. List three strategies that a bisexual chasmogamous flower can evolve to prevent self pollination (autogamy).
2. Given below are the events that are observed in an artificial hybridization programme. Arrange them in the correct sequential order in which they are followed in the hybridisation programme.

- (a) Re-bagging (b) Selection of parents (c) Bagging (d) Dusting the pollen on stigma (e) Emasculation (f) Collection of pollen from male parent.
3. Vivipary automatically limits the number of offsprings in a litter. How?
 4. Does self incompatibility impose any restrictions on autogamy? Give reasons and suggest the method of pollination in such plants.
 5. In the given diagram, write the names of parts shown with lines.

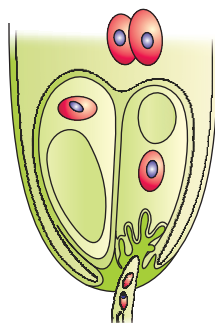


6. What is polyembryony and how can it be commercially exploited?
7. Are parthenocarpy and apomixis different phenomena? Discuss their benefits.

Hint: Yes, they are different. Parthenocarpy leads to development of seedless fruits. Apomixis leads to embryo development.

8. Why does the zygote begin to divide only after the division of Primary endosperm cell (PEC)?
9. The generative cell of a two-celled pollen divides in the pollen tube but not in a three-celled pollen. Give reasons.

10. In the figure given below label the following parts: male gametes, egg cell, polar nuclei, synergid and pollen tube



LONG ANSWER QUESTIONS

1. Starting with the zygote, draw the diagrams of the different stages of embryo development in a dicot.
2. What are the possible types of pollinations in chasmogamous flowers. Give reasons.
3. With a neat, labelled diagram, describe the parts of a mature angiosperm embryo sac. Mention the role of synergids.
4. Draw the diagram of a microsporangium and label its wall layers. Write briefly on the role of the endothecium.
5. Embryo sacs of some apomictic species appear normal but contain diploid cells. Suggest a suitable explanation for the condition.

CHAPTER 3

HUMAN REPRODUCTION

MULTIPLE-CHOICE QUESTIONS

1. Choose the incorrect statement from the following:
 - a. In birds and mammals internal fertilisation takes place
 - b. Colostrum contains antibodies and nutrients
 - c. Polyspermy in mammals is prevented by the chemical changes in the egg surface
 - d. In the human female implantation occurs almost seven days after fertilisation
2. Identify the correct statement from the following:
 - a. High levels of estrogen triggers the ovulatory surge.
 - b. Oogonial cells start to proliferate and give rise to functional ova in regular cycles from puberty onwards.
 - c. Sperms released from seminiferous tubules are highly motile.
 - d. Progesterone level is high during the post ovulatory phase of menstrual cycle.
3. Spot the odd one out from the following structures with reference to the male reproductive system:
 - a. Rete testis
 - b. Epididymis
 - c. Vasa efferentia
 - d. Isthmus
4. Seminal plasma, the fluid part of semen, is contributed by.
 - i. Seminal vesicle
 - ii. Prostate gland
 - iii. Urethra
 - iv. Bulbourethral gland

(a) i and ii (b) i, ii and iv (c) ii, iii and iv (d) i and iv

5. Spermiation is the process of the release of sperms from:
- Seminiferous tubules
 - Vas deferens
 - Epididymis
 - Prostate gland
6. Mature Graafian follicle is generally present in the ovary of a healthy human female around:
- 5 – 8 day of menstrual cycle
 - 11 – 17 day of menstrual cycle
 - 18 – 23 day of menstrual cycle
 - 24 – 28 day of menstrual cycle
7. Acrosomal reaction of the sperm occurs due to:
- Its contact with zona pellucida of the ova
 - Reactions within the uterine environment of the female
 - Reactions within the epididymal environment of the male
 - Androgens produced in the uterus
8. Which one of the following is not a male accessory gland?
- Seminal vesicle
 - Ampulla
 - Prostate
 - Bulbourethral gland
9. The spermatogonia undergo division to produce sperms by the process of spermatogenesis. Choose the correct one with reference to above.
- Spermatogonia have 46 chromosomes and always undergo meiotic cell division
 - Primary spermatocytes divide by mitotic cell division
 - Secondary spermatocytes have 23 chromosomes and undergo second meiotic division
 - Spermatozoa are transformed into spermatids
10. Match between the following representing parts of the sperm and their functions and choose the correct option.

Column I	Column II
A. Head	i. Enzymes
B. Middle piece	ii. Sperm motility
C. Acrosome	iii. Energy
D. Tail	iv. Genetic material

options:

- a. A-ii, B-iv, C-i, D-iii
- b. A-iv, B-iii, C-i, D-ii
- c. A-iv, B-i, C-ii, D-iii
- d. A-ii, B-i, C-iii, D-iv

11. Which among the following has 23 chromosomes?

- a. Spermatogonia
- b. Zygote
- c. Secondary oöcyte
- d. Oögonia

12. Match the following and choose the correct options:

Column I	Column II
A. Trophoblast	i. Embedding of blastocyst in the endometrium
B. Cleavage	ii. Group of cells that would differentiate as embryo
C. Inner cell mass	iii. Outer layer of blastocyst attached to the endometrium
D. Implantation	iv. Mitotic division of zygote

Options:

- a. A-ii, B-i, C-iii, D-iv
- b. A-iii, B-iv, C-ii, D-i
- c. A-iii, B-i, C-ii, D-iv
- d. A-ii, B-iv, C-iii, D-i

13. Which of the following hormones is not secreted by human placenta?

- a. hCG
- b. Estrogens
- c. Progesterone
- d. LH

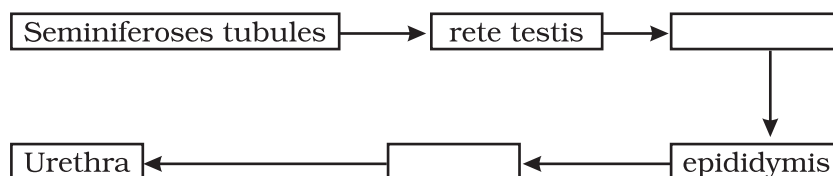
14. The vas deferens receives duct from the seminal vesicle and opens into urethra as:

- a. Epididymis
- b. Ejaculatory duct
- c. Efferent ductule
- d. Ureter

15. Urethral meatus refers to the:
- Urinogenital duct
 - Opening of vas deferens into urethra
 - External opening of the urinogenital duct
 - Muscles surrounding the urinogenital duct
16. Morula is a developmental stage:
- Between the zygote and blastocyst
 - Between the blastocyst and gastrula
 - After the implantation
 - Between implantation and parturition
17. The membranous cover of the ovum at ovulation is:
- Corona radiata
 - Zona radiata
 - Zona pellucida
 - Chorion
18. Identify the odd one from the following:
- Labia minora
 - Fimbriae
 - Infundibulum
 - Isthmus

VERY SHORT ANSWER TYPE QUESTIONS

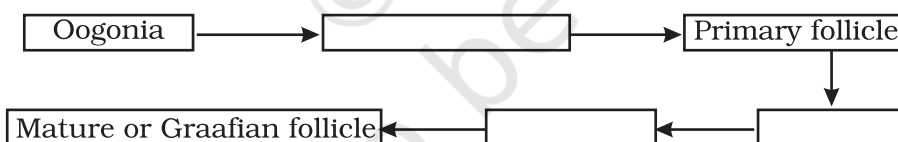
1. Given below are the events in human reproduction. Write them in correct sequential order.
Insemination, gametogenesis, fertilisation, parturition, gestation, implantation
2. The path of sperm transport is given below. Provide the missing steps in blank boxes.



3. What is the role of cervix in the human female reproductive system?
4. Why are menstrual cycles absent during pregnancy.
5. Female reproductive organs and associated functions are given below in column A and B. Fill the blank boxes.

Column A	Column B
Ovaries	Ovulation
Oviduct	a
b	Pregnancy
Vagina	Birth

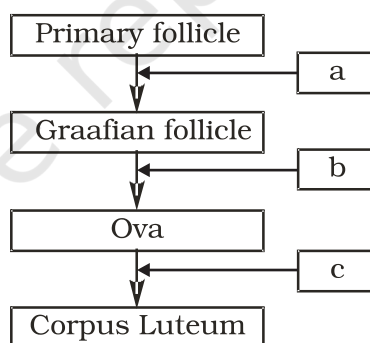
6. From where the parturition signals arise-mother or foetus? Mention the main hormone involved in parturition.
7. What is the significance of epididymis in male fertility?
8. Give the names and functions of the hormones involved in the process of spermatogenesis. Write the names of the endocrine glands from where they are released.
9. The mother germ cells are transformed into a mature follicle through series of steps. Provide the missing steps in the blank boxes.



10. During reproduction, the chromosome number ($2n$) reduces to half (n) in the gametes and again the original number ($2n$) is restored in the offspring. What are the processes through which these events take place?
11. What is the difference between a primary oöcyte and a secondary oöcyte?
12. What is the significance of ampullary-isthmic junction in the female reproductive tract?
13. How does zona pellucida of ovum help in preventing polyspermy?
14. Mention the importance of LH surge during menstrual cycle.
15. Which type of cell division forms spermatids from the secondary spermatocytes?

SHORT ANSWER TYPE QUESTIONS

1. A human female experiences two major changes, menarche and menopause during her life. Mention the significance of both the events.
2.
 - a. How many spermatozoa are formed from one secondary spermatocyte?
 - b. Where does the first cleavage division of zygote take place?
3. Corpus luteum in pregnancy has a long life. However, if fertilisation does not take place, it remains active only for 10-12 days. Explain.
4. What is foetal ejection reflex? Explain how it leads to parturition?
5. Except endocrine function, what are the other functions of placenta.
6. Why doctors recommend breast feeding during initial period of infant growth?
7. What are the events that take place in the ovary and uterus during follicular phase of the menstrual cycle.
8. Given below is a flow chart showing ovarian changes during menstrual cycle. Fill in the spaces giving the name of the hormones responsible for the events shown.



9. Give a schematic labelled diagram to represent oögenesis (without descriptions)
10. What are the changes in the oogonia during the transition of a primary follicle to Graafian follicle?

LONG ANSWER QUESTIONS

1. What role does pituitary gonadotropins play during follicular and ovulatory phases of menstrual cycle? Explain the shifts in steroidal secretions.

2. Meiotic division during oogenesis is different from that in spermatogenesis. Explain how and why?
3. The zygote passes through several developmental stages till implantation, Describe each stage briefly with suitable diagrams.
4. Draw a neat diagram of the female reproductive system and label the parts associated with the following (a) production of gamete, (b) site of fertilisation (c) site of implantation and, (d) birth canal.
5. With a suitable diagram, describe the organisation of mammary gland.

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CHAPTER 4

REPRODUCTIVE HEALTH

MULTIPLE-CHOICE QUESTIONS

1. The method of directly injecting a sperm into ovum in Assisted Reproductive Technology is called:
 - a. GIFT
 - b. ZIFT
 - c. ICSI
 - d. ET
2. Increased IMR and decreased MMR in a population will:
 - a. Cause rapid increase in growth rate
 - b. Result in decline in growth rate
 - c. Not cause significant change in growth rate
 - d. Result in an explosive population
3. Intensely lactating mothers do not generally conceive due to the:
 - a. Suppression of gonadotropins
 - b. Hyper secretion of gonadotropins
 - c. Suppression of gametic transport
 - d. Suppression of fertilisation
4. Sterilisation techniques are generally fool proof methods of contraception with least side effects. Yet, this is the last option for the couples because:
 - i. It is almost irreversible
 - ii. Of the misconception that it will reduce sexual urge
 - iii. It is a surgical procedure
 - iv. Of lack of sufficient facilities in many parts of the country

Choose the correct option:

(a) i and iii (b) ii and iii (c) ii and iv (d) i, ii, iii and iv

5. A national level approach to build up a reproductively healthy society was taken up in our country in:
 - a. 1950s
 - b. 1960s
 - c. 1980s
 - d. 1990s
6. Emergency contraceptives are effective if used within:
 - a. 72 hrs of coitus
 - b. 72 hrs of ovulation
 - c. 72 hrs of menstruation
 - d. 72 hrs of implantation
7. Choose the right one among the statements given below:
 - a. IUDs are generally inserted by the user herself
 - b. IUDs increase phagocytosis reaction in the uterus
 - c. IUDs suppress gametogenesis
 - d. IUDs once inserted need not be replaced
8. Following statements are given regarding MTP. Choose the correct options given below:
 - i. MTPs are generally advised during first trimester
 - ii. MTPs are used as a contraceptive method
 - iii. MTPs are always surgical
 - iv. MTPs require the assistance of qualified medical personnel

(a) ii and iii (b) ii and iii (c) i and iv (d) i and ii
9. From the sexually transmitted diseases mentioned below, identify the one which does not specifically affect the sex organs:
 - a. Syphilis
 - b. AIDS
 - c. Gonorrhea
 - d. Genital warts
10. Condoms are one of the most popular contraceptives because of the following reasons:
 - a. These are effective barriers for insemination
 - b. They do not interfere with coital act
 - c. These help in reducing the risk of STDs
 - d. All of the above

11. Choose the correct statement regarding the ZIFT procedure:
- Ova collected from a female donor are transferred to the fallopian tube to facilitate zygote formation.
 - Zygote is collected from a female donor and transferred to the fallopian tube
 - Zygote is collected from a female donor and transferred to the uterus
 - Ova collected from a female donor and transferrerd to the uterus
12. The correct surgical procedure as a contraceptive method is:
- Ovariectomy
 - Hysterectomy
 - Vasectomy
 - Castration
13. Diaphragms are contraceptive devices used by the females. Choose the correct option from the statements given below:
- They are introduced into the uterus
 - They are placed to cover the cervical region
 - They act as physical barriers for sperm entry
 - They act as spermicidal agents
- (a) i and ii, (b) i and iii, (c) ii and iii, (d) iii & iv

VERY SHORT ANSWER TYPE QUESTIONS

- Reproductive health refers only to healthy reproductive functions. Comment.
- Comment on the Reproductive and Child Health Care programme of the government to improve the reproductive health of the people.
- The present population growth rate in India is alarming. Suggest ways to check it.
- STDs can be considered as self-invited diseases. Comment.
- Suggest the reproduction-related aspects in which counselling should be provided at the school level.
- Mention the primary aim of the “Assisted Reproductive Technology” (ART) programme.
- What is the significance of progesterone-estrogen combination as a contraceptive measure?

8. Strict conditions are to be followed in medical termination of pregnancy (MTP) procedures. Mention two reasons.
9. Males in whom testes fail to descend to the scrotum are generally infertile. Why?
10. Mention two advantages of lactational amenorrhea as a contraceptive method.

SHORT ANSWER TYPE QUESTIONS

1. Suggest some important steps that you would recommend to be taken to improve the reproductive health standards in India.
2. The procedure of GIFT involves the transfer of female gamete to the fallopian tube. Can gametes be transferred to the uterus to achieve the same result? Explain.
3. Copper ions-releasing IUDs are more efficient than non-medicated methods. Why?
4. What are the probable factors that contributed to population explosion in India?
5. Briefly explain IVF and ET. What are the conditions in which these methods are advised?
6. What are the advantages of natural methods of contraception over artificial methods?
7. What are the conditions in which medical termination of pregnancy is advised?
8. Comment on the essential features required for an ideal contraceptive.
9. All reproductive tract infections RTIs are STDs, but all STDs are not RTIs. Justify with example.

LONG ANSWER TYPE QUESTIONS

1. What are the Assisted Reproductive Techniques practised to help infertile couples? Describe any three techniques.
2. Discuss the mode of action and advantages/disadvantages of hormonal contraceptives.
3. STDs are a threat to reproductive health. Describe any two such diseases and suggest preventive measures.

4. Do you justify the statutory ban on aminocentesis in our country? Give reasons.
5. Enumerate and describe any five reasons for introducing sex education to school-going children.

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CHAPTER 5

PRINCIPLE OF INHERITANCE AND VARIATION

MULTIPLE-CHOICE QUESTIONS

1. All genes located on the same chromosome:
 - a. Form different groups depending upon their relative distance
 - b. Form one linkage group
 - c. Will not form any linkage groups
 - d. Form interactive groups that affect the phenotype
2. Conditions of a karyotype $2n + 1$, $2n - 1$ and $2n + 2$, $2n - 2$ are called:
 - a. Aneuploidy
 - b. Polyploidy
 - c. Allopolyploidy
 - d. Monosomy
3. Distance between the genes and percentage of recombination shows:
 - a. a direct relationship
 - b. an inverse relationship
 - c. a parallel relationship
 - d. no relationship
4. If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is:
 - a. Autosomal dominant
 - b. Autosomal recessive
 - c. Sex-linked dominant
 - d. Sex-linked recessive

5. In sickle cell anaemia glutamic acid is replaced by valine. Which one of the following triplets codes for valine?
 - a. G G G
 - b. A A G
 - c. G A A
 - d. G U G
6. Person having genotype $I^A I^B$ would show the blood group as AB. This is because of:
 - a. Pleiotropy
 - b. Co-dominance
 - c. Segregation
 - d. Incomplete dominance
7. ZZ / ZW type of sex determination is seen in:
 - a. Platypus
 - b. Snails
 - c. Cockroach
 - d. Peacock
8. A cross between two tall plants resulted in offspring having few dwarf plants. What would be the genotypes of both the parents?
 - a. TT and Tt
 - b. Tt and Tt
 - c. TT and TT
 - d. Tt and tt
9. In a dihybrid cross, if you get 9:3:3:1 ratio it denotes that:
 - a. The alleles of two genes are interacting with each other
 - b. It is a multigenic inheritance
 - c. It is a case of multiple allelism
 - d. The alleles of two genes are segregating independently.
10. Which of the following will not result in variations among siblings?
 - a. Independent assortment of genes
 - b. Crossing over
 - c. Linkage
 - d. Mutation

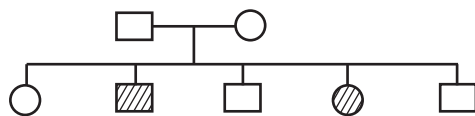
11. Mendel's Law of independent assortment holds good for genes situated on the:
 - a. non-homologous chromosomes
 - b. homologous chromosomes
 - c. extra nuclear genetic element
 - d. same chromosome
12. Occasionally, a single gene may express more than one effect. The phenomenon is called:
 - a. multiple allelism
 - b. mosaicism
 - c. pleiotropy
 - d. polygeny
13. In a certain taxon of insects some have 17 chromosomes and the others have 18 chromosomes. The 17 and 18 chromosome-bearing organisms are:
 - a. males and females, respectively
 - b. females and males, respectively
 - c. all males
 - d. all females
14. The inheritance pattern of a gene over generations among humans is studied by the pedigree analysis. Character studied in the pedigree analysis is equivalent to:
 - a. quantitative trait
 - b. Mendelian trait
 - c. polygenic trait
 - d. maternal trait
15. It is said that Mendel proposed that the factor controlling any character is discrete and independent. His proposition was based on the
 - a. results of F_3 generation of a cross.
 - b. observations that the offspring of a cross made between the plants having two contrasting characters shows only one character without any blending.
 - c. self pollination of F_1 offsprings
 - d. cross pollination of F_1 generation with recessive parent

16. Two genes 'A' and 'B' are linked. In a dihybrid cross involving these two genes, the F_1 heterozygote is crossed with homozygous recessive parental type (aa bb). What would be the ratio of offspring in the next generation?
- 1 : 1 : 1 : 1
 - 9 : 3 : 3 : 1
 - 3 : 1
 - 1 : 1
17. In the F_2 generation of a Mendelian dihybrid cross the number of phenotypes and genotypes are:
- phenotypes - 4; genotypes - 16
 - phenotypes - 9; genotypes - 4
 - phenotypes - 4; genotypes - 8
 - phenotypes - 4; genotypes - 9
18. Mother and father of a person with 'O' blood group have 'A' and 'B' blood group, respectively. What would be the genotype of both mother and father?
- Mother is homozygous for 'A' blood group and father is heterozygous for 'B'
 - Mother is heterozygous for 'A' blood group and father is homozygous for 'B'
 - Both mother and father are heterozygous for 'A' and 'B' blood group, respectively
 - Both mother and father are homozygous for 'A' and 'B' blood group, respectively

VERY SHORT ANSWER TYPE QUESTIONS

- What is the cross between the progeny of F_1 and the homozygous recessive parent called? How is it useful?
- Do you think Mendel's laws of inheritance would have been different if the characters that he chose were located on the same chromosome.
- Enlist the steps of controlled cross pollination. Would emasculation be needed in a cucurbit plant? Give reasons for your answer.
- A person has to perform crosses for the purpose of studying inheritance of a few traits / characters. What should be the criteria for selecting the organisms?

5. The pedigree chart given below shows a particular trait which is absent in parents but present in the next generation irrespective of sexes. Draw your conclusion on the basis of the pedigree.



6. In order to obtain the F_1 generation Mendel pollinated a pure-breeding tall plant with a pure breeding dwarf plant. But for getting the F_2 generation, he simply self-pollinated the tall F_1 plants. Why?
7. "Genes contain the information that is required to express a particular trait." Explain.
8. How are alleles of particular gene differ from each other? Explain its significance.
9. In a monohybrid cross of plants with red and white flowered plants, Mendel got only red flowered plants. On self-pollinating these F_1 plants got both red and white flowered plants in 3:1 ratio. Explain the basis of using RR and rr symbols to represent the genotype of plants of parental generation.
10. For the expression of traits genes provide only the potentiality and the environment provides the opportunity. Comment on the veracity of the statement.
11. A, B, D are three independently assorting genes with their recessive alleles a, b, d, respectively. A cross was made between individuals of Aa bb DD genotype with aa bb dd. Find out the type of genotypes of the offspring produced.
12. In our society a woman is often blamed for not bearing male child. Do you think it is right? Justify.
13. Discuss the genetic basis of wrinkled phenotype of pea seed.
14. Even if a character shows multiple allelism, an individual will only have two alleles for that character. Why?
15. How does a mutagen induce mutation? Explain with example.

SHORT ANSWER TYPE QUESTIONS

1. In a Mendelian monohybrid cross, the F_2 generation shows identical genotypic and phenotypic ratios. What does it tell us about the nature of alleles involved? Justify your answer.

2. Can a child have blood group O if his parents have blood group 'A' and 'B'. Explain.
3. What is Down's syndrome? Give its symptoms and cause. Why is it that the chances of having a child with Down's syndrome increases if the age of the mother exceeds forty years?
4. How was it concluded that genes are located on chromosomes?
5. A plant with red flowers was crossed with another plant with yellow flowers. If F_1 showed all flowers orange in colour, explain the inheritance.
6. What are the characteristic features of a true-breeding line?
7. In peas, tallness is dominant over dwarfness, and red colour of flowers is dominant over the white colour. When a tall plant bearing red flowers was pollinated with a dwarf plant bearing white flowers, the different phenotypic groups were obtained in the progeny in numbers mentioned against them:

Tall, Red = 138

Tall, White = 132

Dwarf, Red = 136

Dwarf, White = 128

Mention the genotypes of the two parents and of the four offspring types.

8. Why is the frequency of red-green colour blindness is many times higher in males than that in the females?
9. If a father and son are both defective in red-green colour vision, is it likely that the son inherited the trait from his father? Comment.
10. Discuss why *Drosophila* has been used extensively for genetical studies.
11. How do genes and chromosomes share similarity from the point of view of genetical studies?
12. What is recombination? Discuss the applications of recombination from the point of view of genetic engineering.
13. What is artificial selection? Do you think it affects the process of natural selection? How?
14. With the help of an example differentiate between incomplete dominance and co-dominance.
15. It is said, that the harmful alleles get eliminated from population over a period of time, yet sickle cell anaemia is persisting in human population. Why?

LONG ANSWER TYPE QUESTIONS

1. In a plant tallness is dominant over dwarfness and red flower is dominant over white. Starting with the parents work out a dihybrid cross. What is standard dihybrid ratio? Do you think the values would deviate if the two genes in question are interacting with each other?
2.
 - a. In humans, males are heterogametic and females are homogametic. Explain. Are there any examples where males are homogametic and females heterogametic?
 - b. Also describe as to, who determines the sex of an unborn child? Mention whether temperature has a role in sex determination.
3. A normal visioned woman, whose father is colour blind, marries a normal visioned man. What would be probability of her sons and daughters to be colour blind? Explain with the help of a pedigree chart.
4. Discuss in detail the contributions of Morgan and Sturvant in the area of genetics.
5. Define aneuploidy. How is it different from polyploidy? Describe the individuals having following chromosomal abnormalities.
 - a. Trisomy of 21st Chromosome
 - b. XXY
 - c. XO

CHAPTER 6

MOLECULAR BASIS OF INHERITANCE

MULTIPLE-CHOICE QUESTIONS

1. In a DNA strand the nucleotides are linked together by:
 - a. glycosidic bonds
 - b. phosphodiester bonds
 - c. peptide bonds
 - d. hydrogen bonds
2. A nucleoside differs from a nucleotide. It lacks the:
 - a. base
 - b. sugar
 - c. phosphate group
 - d. hydroxyl group
3. Both deoxyribose and ribose belong to a class of sugars called:
 - a. trioses
 - b. hexoses
 - c. pentoses
 - d. polysaccharides
4. The fact that a purine base always pairs through hydrogen bonds with a pyrimidine base in the DNA double helix leads to:
 - a. the antiparallel nature
 - b. the semiconservative nature
 - c. uniform width throughout DNA
 - d. uniform length in all DNA
5. The net electric charge on DNA and histones is:
 - a. both positive
 - b. both negative
 - c. negative and positive, respectively
 - d. zero

6. The promoter site and the terminator site for transcription are located at:
 - a. 3' (downstream) end and 5' (upstream) end, respectively of the transcription unit
 - b. 5' (upstream) end and 3' (downstream) end, respectively of the transcription unit
 - c. the 5' (upstream) end
 - d. the 3' (downstream) end
7. Which of the following statements is the most appropriate for sickle cell anaemia?
 - a. It cannot be treated with iron supplements
 - b. It is a molecular disease
 - c. It confers resistance to acquiring malaria
 - d. All of the above
8. Which of the following is true with respect to AUG?
 - a. It codes for methionine only
 - b. It is an initiation codon
 - c. It codes for methionine in both prokaryotes and eukaryotes
 - d. All of the above
9. The first genetic material could be:
 - a. protein
 - b. carbohydrates
 - c. DNA
 - d. RNA
10. With regard to mature mRNA in eukaryotes:
 - a. exons and introns do not appear in the mature RNA
 - b. exons appear but introns do not appear in the mature RNA
 - c. introns appear but exons do not appear in the mature RNA
 - d. both exons and introns appear in the mature RNA
11. The human chromosome with the highest and least number of genes in them are respectively:
 - a. Chromosome 21 and Y
 - b. Chromosome 1 and X
 - c. Chromosome 1 and Y
 - d. Chromosome X and Y

12. Who amongst the following scientists had no contribution in the development of the double helix model for the structure of DNA?
- Rosalind Franklin
 - Maurice Wilkins
 - Erwin Chargaff
 - Meselson and Stahl
13. DNA is a polymer of nucleotides which are linked to each other by 3'-5' phosphodiester bond. To prevent polymerisation of nucleotides, which of the following modifications would you choose?
- Replace purine with pyrimidines
 - Remove/Replace 3' OH group in deoxy ribose
 - Remove/Replace 2' OH group with some other group in deoxy ribose
 - Both 'b' and 'c'
14. Discontinuous synthesis of DNA occurs in one strand, because:
- DNA molecule being synthesised is very long
 - DNA dependent DNA polymerase catalyses polymerisation only in one direction (5' → 3')
 - it is a more efficient process
 - DNA ligase joins the short stretches of DNA
15. Which of the following steps in transcription is catalysed by RNA polymerase?
- Initiation
 - Elongation
 - Termination
 - All of the above
16. Control of gene expression in prokaryotes take place at the level of:
- DNA-replication
 - Transcription
 - Translation
 - None of the above
17. Which of the following statements is correct about the role of regulatory proteins in transcription in prokaryotes?
- They only increase expression
 - They only decrease expression
 - They interact with RNA polymerase but do not affect the expression
 - They can act both as activators and as repressors

18. Which was the last human chromosome to be completely sequenced:
- Chromosome 1
 - Chromosome 11
 - Chromosome 21
 - Chromosome X
19. Which of the following are the functions of RNA?
- It is a carrier of genetic information from DNA to ribosomes synthesising polypeptides.
 - It carries amino acids to ribosomes.
 - It is a constituent component of ribosomes.
 - All of the above.
20. While analysing the DNA of an organism a total number of 5386 nucleotides were found out of which the proportion of different bases were: Adenine = 29%, Guanine = 17%, Cytosine = 32%, Thymine = 17%. Considering the Chargaff's rule it can be concluded that:
- it is a double stranded circular DNA
 - It is single stranded DNA
 - It is a double stranded linear DNA
 - No conclusion can be drawn
21. In some viruses, DNA is synthesised by using RNA as template. Such a DNA is called:
- A-DNA
 - B-DNA
 - cDNA
 - rDNA
22. If Meselson and Stahl's experiment is continued for four generations in bacteria, the ratio of N^{15}/N^{15} : N^{15}/N^{14} : N^{14}/N^{14} containing DNA in the fourth generation would be:
- 1:1:0
 - 1:4:0
 - 0:1:3
 - 0:1:7
23. If the sequence of nitrogen bases of the coding strand of DNA in a transcription unit is:
- 5' - A T G A A T G - 3',
- the sequence of bases in its RNA transcript would be;
- 5' - A U G A A U G - 3'

- b. 5' - U A C U U A C - 3'
 - c. 5' - C A U U C A U - 3'
 - d. 5' - G U A A G U A - 3'
24. The RNA polymerase holoenzyme transcribes:
- a. the promoter, structural gene and the terminator region
 - b. the promoter and the terminator region
 - c. the structural gene and the terminator region
 - d. the structural gene only.
25. If the base sequence of a codon in mRNA is 5'-AUG-3', the sequence of tRNA pairing with it must be:
- a. 5' - UAC - 3'
 - b. 5' - CAU - 3'
 - c. 5' - AUG - 3'
 - d. 5' - GUA - 3'
26. The amino acid attaches to the tRNA at its:
- a. 5' - end
 - b. 3' - end
 - c. Anti codon site
 - d. DHU loop
27. To initiate translation, the mRNA first binds to:
- a. The smaller ribosomal sub-unit,
 - b. The larger ribosomal sub-unit
 - c. The whole ribosome
 - d. No such specificity exists.
28. In *E.coli*, the lac operon gets switched on when:
- a. lactose is present and it binds to the repressor
 - b. repressor binds to operator
 - c. RNA polymerase binds to the operator
 - d. lactose is present and it binds to RNA polymerase

VERY SHORT ANSWER TYPE QUESTIONS

1. What is the function of histones in DNA packaging?
2. Distinguish between heterochromatin and euchromatin. Which of the two is transcriptionally active?

3. The enzyme DNA polymerase in *E.coli* is a DNA dependent polymerase and also has the ability to proof-read the DNA strand being synthesised. Explain. Discuss the dual polymerase.
4. What is the cause of discontinuous synthesis of DNA on one of the parental strands of DNA? What happens to these short stretches of synthesised DNA?
5. Given below is the sequence of coding strand of DNA in a transcription unit
3' A A T G C A G C T A T T A G G - 5'
write the sequence of
 - a) its complementary strand
 - b) the mRNA
6. What is DNA polymorphism? Why is it important to study it?
7. Based on your understanding of genetic code, explain the formation of any abnormal hemoglobin molecule. What are the known consequences of such a change?
8. Sometimes cattle or even human beings give birth to their young ones that are having extremely different sets of organs like limbs/position of eye(s) etc. Comment.
9. In a nucleus, the number of ribonucleoside triphosphates is 10 times the number of deoxy x10 ribonucleoside triphosphates, but only deoxy ribonucleotides are added during the DNA replication. Suggest a mechanism.
10. Name a few enzymes involved in DNA replication other than DNA polymerase and ligase. Name the key functions for each of them.
11. Name any three viruses which have RNA as the genetic material.

SHORT ANSWER TYPE QUESTIONS

1. Define transformation in Griffith's experiment. Discuss how it helps in the identification of DNA as the genetic material.
2. Who revealed biochemical nature of the transforming principle? How was it done?
3. Discuss the significance of heavy isotope of nitrogen in the Meselson and Stahl's experiment.

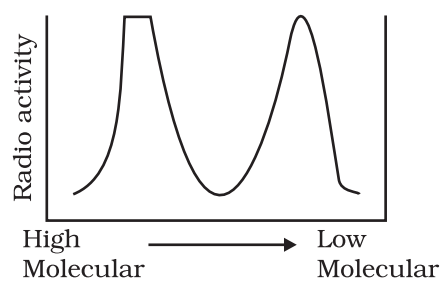
4. Define a cistron. Giving examples differentiate between monocistronic and polyeistronic transcription unit.
5. Give any six features of the human genome.
6. During DNA replication, why is it that the entire molecule does not open in one go? Explain replication fork. What are the two functions that the monomers (d NTPs) play?
7. Retroviruses do not follow central Dogma. Comment.
8. In an experiment, DNA is treated with a compound which tends to place itself amongst the stacks of nitrogenous base pairs. As a result of this, the distance between two consecutive base increases. from 0.34nm to 0.44 nm calculate the length of DNA double helix (which has 2×10^9 bp) in the presence of saturating amount of this compound.
9. What would happen if histones were to be mutated and made rich in acidic amino acids such as aspartic acid and glutamic acid in place of basic amino acids such as lysine and arginine?
10. Recall the experiments done by Frederick Griffith, Avery, MacLeod and McCarty, where DNA was speculated to be the genetic material. If RNA, instead of DNA was the genetic material, would the heat killed strain of Pneumococcus have transformed the R-strain into virulent strain? Explain.
11. You are repeating the Hershey-Chase experiment and are provided with two isotopes: ^{32}P and ^{15}N (in place of ^{35}S in the original experiment). How do you expect your results to be different?
12. There is only one possible sequence of amino acids when deduced from a given nucleotides. But multiple nucleotides sequence can be deduced from a single amino acid sequence. Explain this phenomena.
13. A single base mutation in a gene may not 'always' result in loss or gain of function. Do you think the statement is correct? Defend your answer.
14. A low level of expression of lac operon occurs at all the time. Can you explain the logic behind this phenomena.
15. How has the sequencing of human genome opened new windows for treatment of various genetic disorders. Discuss amongst your classmates.
16. The total number of genes in humans is far less ($< 25,000$) than the previous estimate (upto 1,40,000 gene). Comment.
17. Now, sequencing of total genomes getting is getting less expensive day by the day. Soon it may be affordable for a common man to get his genome sequenced. What in your opinion could be the advantage and disadvantage of this development?

18. Would it be appropriate to use DNA probes such as VNTR in DNA finger printing of a bacteriophage?
19. During in vitro synthesis of DNA, a researcher used 2', 3' – dideoxy cytidine triphosphate as raw nucleotide in place of 2'-deoxy cytidine. What would be the consequence?
20. What background information did Watson and Crick have made available for developing a model of DNA? What was their contribution?
21. What are the functions of (i) methylated guanosine cap, (ii) poly-A “tail” in a mature mRNA?
22. Do you think that the alternate splicing of exons may enable a structural gene to code for several isoproteins from one and the same gene? If yes, how? If not, why so?
23. Comment on the utility of variability in number of tandem repeats during DNA finger printing.

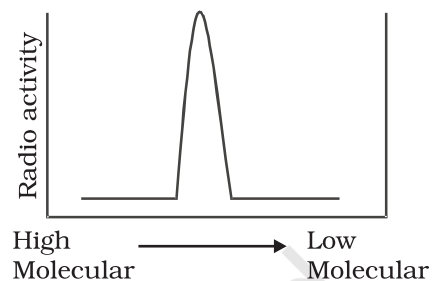
LONG ANSWER TYPE QUESTIONS

1. Give an account of Hershey and Chase experiment. What did it conclusively prove? If both DNA and proteins contained phosphorus and sulphur do you think the result would have been the same?
2. During the course of evolution why DNA was chosen over RNA as genetic material? Give reasons by first discussing the desired criteria in a molecule that can act as genetic material and in the light of biochemical differences between DNA and RNA.
3. Give an account of post transcriptional modifications of a eukaryotic mRNA.
4. Discuss the process of translation in detail.
5. Define an operon, giving an example, explain an Inducible operon.
6. ‘There is a paternity dispute for a child’. Which technique can solve the problem. Discuss the principle involved.
7. Give an account of the methods used in sequencing the human genome.
8. List the various markers that are used in DNA finger printing.
9. Replication was allowed to take place in the presence of radioactive deoxynucleotides precursors in *E.coli* that was a mutant for DNA ligase. Newly synthesised radioactive DNA was purified and strands

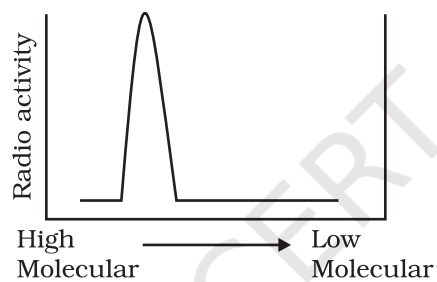
were separated by denaturation. These were centrifuged using density gradient centrifugation. Which of the following would be a correct result?



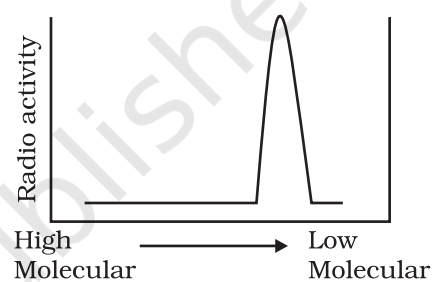
(a)



(b)



(c)



(d)

CHAPTER 7

EVOLUTION

MULTIPLE CHOICE QUESTIONS

1. Which of the following is used as an atmospheric pollution indicator?
 - a. Lepidoptera
 - b. Lichens
 - c. *Lycopersicon*
 - d. *Lycopodium*
2. The theory of spontaneous generation stated that:
 - a. life arose from living forms only
 - b. life can arise from both living and non-living
 - c. life can arise from non-living things only.
 - d. life arises spontaneously, neither from living nor from the non-living.
3. Animal husbandry and plant breeding programmes are the examples of:
 - a. reverse evolution
 - b. artificial selection
 - c. mutation
 - d. natural selection
4. Palaentological evidences for evolution refer to the:
 - a. development of embryo
 - b. homologous organs
 - c. fossils
 - d. analogous organs.
5. The bones of forelimbs of whale, bat, cheetah and man are similar in structure, because:
 - a. one organism has given rise to another
 - b. they share a common ancestor

- c. they perform the same function
 - d. they have biochemical similarities
6. Analogous organs arise due to:
- a. divergent evolution
 - b. artificial selection
 - c. genetic drift
 - d. convergent evolution
7. $(p+q)^2 = p^2 + 2pq + q^2 = 1$ represents an equation used in:
- a. population genetics
 - b. mendelian genetics
 - c. biometrics
 - d. molecular genetics
8. Appearance of antibiotic-resistant bacteria is an example of:
- a. adaptive radiation
 - b. transduction
 - c. pre-existing variation in the population
 - d. divergent evolution
9. Evolution of life shows that life forms had a trend of moving from:
- a. land to water
 - b. dryland to wet land
 - c. fresh water to sea water
 - d. water to land
10. Viviparity is considered to be more evolved because:
- a. the young ones are left on their own
 - b. the young ones are protected by a thick shell
 - c. the young ones are protected inside the mother's body and are looked after they are born leading to more chances of survival
 - d. the embryo takes a long time to develop
11. Fossils are generally found in:
- a. Sedimentary rocks
 - b. Igneous rocks
 - c. Metamorphic rocks
 - d. Any type of rock

12. For the MN-blood group system, the frequencies of M and N alleles are 0.7 and 0.3, respectively. The expected frequency of MN-blood group bearing organisms is likely to be
- 42%
 - 49%
 - 9%
 - 58%
13. Which type of selection explains industrial melanism observed in moth, *Biston bitularia*:
- Stabilising
 - Directional
 - Disruptive
 - Artificial
14. The most accepted line of descent in human evolution is:
- Australopithecus → Ramapithecus → *Homo sapiens* → *Homo habilis*
 - Homo erectus* → *Homo habilis* → *Homo sapiens*
 - Ramapithecus → *Homo habilis* → *Homo erectus* → *Homo sapiens*
 - Australopithecus → Ramapithecus → *Homo erectus* → *Homo habilis* → *Homo sapiens*.
15. Which of the following is an example for link species?
- Lobe fish
 - Dodo bird
 - Sea weed
 - Chimpanzee
16. Match the scientists listed under column 'I' with ideas listed column 'II'.

Column I	Column II
A. Darwin	i. abiogenesis
B. Oparin	ii. use and disuse of organs
C. Lamarck	iii. continental drift theory
D. Wagner	iv. evolution by natural selection
a. A-i; B-iv; C-ii; D-iii	
b. A-iv; B-i; C-ii; D-iii	
c. A-ii; B-iv; C-iii; D-i	
d. A-iv; B-iii; C-ii; D-i	

17. In 1953 S. L. Miller created primitive earth conditions in the laboratory and gave experimental evidence for origin of first form of life from pre-existing non-living organic molecules. The primitive earth conditions created include:
- low temperature, volcanic storms, atmosphere rich in oxygen
 - low temperature, volcanic storms, reducing atmosphere
 - high temperature, volcanic storms, non-reducing atmosphere
 - high temperature, volcanic storms, reducing atmosphere containing CH_4 , NH_3 etc.
18. Variations during mutations of meiotic recombinations are:
- random and directionless
 - random and directional
 - small and directional
 - random, small and directional

VERY SHORT ANSWER TYPE QUESTIONS

- What were the characteristics of life forms that had been fossilised?
- Did aquatic life forms get fossilised? If, yes where do we come across such fossils?
- What are we referring to? When we say 'simple organisms' or 'complex organisms'.
- How do we compute the age of a living tree?
- Give an example for convergent evolution and identify the features towards which they are converging.
- How do we compute the age of a fossil?
- What is the most important pre-condition for adaptive radiation?
- How do we compute the age of a rock?
- When we talk of functional macromolecules (e.g. proteins as enzymes, hormones, receptors, antibodies etc), towards what are they evolving?
- In a certain population, the frequency of three genotypes is as follows:

Genotypes:	BB	Bb	bb
frequency:	22%	62%	16%

What is the likely frequency of B and b alleles?

11. Among the five factors that are known to affect Hardy-Weinberg equilibrium, three factors are gene flow, genetic drift and genetic recombination. What are the other two factors?
12. What is founder effect?
13. Who among the *Dryopithecus* and *Ramapithecus* was more man-like?
14. By what Latin name the first hominid was known?
15. Among *Ramapithecus*, *Australopithecines* and *Homo habilis* - who probably did not eat meat?

SHORT ANSWER TYPE QUESTIONS

1. Louis Pasteur's experiments, if you recall, proved that life can arise from only pre-existing life. Can we correct this as life evolves from pre-existent life or otherwise we will never answer the question as to how the first forms of life arose? Comment.
2. The scientists believe that evolution is gradual. But extinction, part of evolutionary story, are 'sudden' and 'abrupt' and also group-specific. Comment whether a natural disaster can be the cause for extinction of species.
3. Why is nascent oxygen supported to be toxic to aerobic life forms?
4. While creation and presence of variation is directionless, natural selection is directional as it is in the context of adaptation. Comment.
5. The evolutionary story of moths in England during industrialisation reveals, that 'evolution is apparently reversible'. Clarify this statement.
6. Comment on the statement that "evolution and natural selection are end result or consequence of some other processes but themselves are not processes".
7. State and explain any three factors affecting allele frequency in populations.
8. Gene flow occurs through generations. Gene flow can occur across language barriers in humans. If we have a technique of measuring specific allele frequencies in different population of the world, can we not predict human migratory patterns in pre-history and history? Do you agree or disagree? Provide explanation to your answer.

9. How do you express the meaning of words like race, breed, cultivars or variety?
10. When we say "survival of the fittest", does it mean that
 - a. those which are fit only survive, or
 - b. those that survive are called fit?Comment.
11. Enumerate three most characteristic criteria for designating a Mendelian population.
12. "Migration may enhance or blurr the effects of selection". Comment.

LONG ANSWER TYPE QUESTIONS

1. Name the law that states that the sum of allelic frequencies in a population remains constant. What are the five factors that influence these values?
2. Explain divergent evolution in detail. What is the driving force behind it?
3. You have studied the story of Pepper moths in England. Had the industries been removed, what impact could it have on the moth population? Discuss.
4. What are the key concepts in the evolution theory of Darwin?
5. Two organisms occupying a particular geographical area (say desert) show similar adaptive strategies. Taking examples, describe the phenomenon.
6. We are told that evolution is a continuing phenomenon for all living things. Are humans also evolving? Justify your answer.
7. Had Darwin been aware of Mendel's work, would he been able to explain the origin of variations. Discuss.