

***LIST OF MEMBERS WHO PREPARED
QUESTION BANK FOR BIOLOGY FOR CLASS XII***

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CHAPTER 1

REPRODUCTION IN ORGANISMS

POINTS TO REMEMBER

Binary Fission : Division of parental body into two equal halves.

Bulbils : Small, fleshy specialised buds as in *Agave*.

Clone : Morphologically and genetically similar individuals

Diploid : Organism with '2n' number chromosomes.

Dioecious : Plants bearing only one type of flower either male or female *e.g.*, Papaya, Date Palm

Embryogenesis : Process of development of embryo from zygote.

Gametogenesis: Process of formation of male and female gametes.

Haploid : Organisms with 'n' number of chromosomes.

Heterogametes : Gametes produced are of two morphologically distinct types.

Hermaphrodites : Organisms possessing both male and female reproductive organs.

Isogametes (Homogametes) : Female and male gametes are similar in appearance.

Juvenile Phase : It is the period of growth before maturity when sex organs are not functional.

Life span : The period from birth to natural death of an organism.

Monoecious : The plant that bear both male and female sex flowers.

Meiocytes : Specialized cells of diploid organisms which undergo meiosis.

Menstrual Cycle : Sexual or reproductive cycle in sexually mature primate mammals.

Oviparous : When female lays fertilised or unfertilised eggs and the development of embryo takes place outside the body of female.

Oestrous Cycle : Sexual or reproductive cycle.

Pericarp : Protective covering of fruit. May be divided into epicarp, mesocarp and endocarp.

Parthenogenesis : Development of unfertilised ovum into fully formed organism.

Pistillate : Unisexual flowers with female sex organs only (pistil).

Pollination : Transfer of pollen grains from anther to stigma.

Staminate : Unisexual flowers with male sex organs only (stamens).

Syngamy : Fusion of male and female gamete.

Senescence : Period between sexual maturity and death.

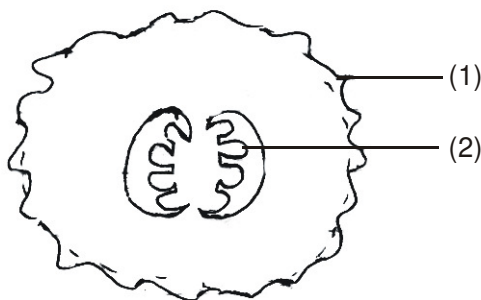
Viviparous : The zygote develops into a young one in the body of female organism.

Zoospores : Asexual, motile, microscopic reproductive structures in case of several algae and fungi.

QUESTIONS

VSA (1 MARK)

1. Offsprings produced by a sexual reproduction are referred to as clones. Why?
2. Which property of *Bryophyllum* plant is fully exploited by gardeners and farmers for commercial propagation of such plants.
3. What is unusual about flowering in :
(a) Bamboo (b) *Strobilanthus*
4. Name the most invasive aquatic weed which drains oxygen from water and leads to death of fishes.
5. In organisms like rotifers, honey bees, some lizards and bird, the female gamete undergoes development to form new organism without fertilisation. What is this phenomena called?
6. "Asexual reproduction does not produce the genetic variability." Give reason.
7. Mention the medium for transport of gamete in Algae, Bryophyte, Pteridophyte.
8. Banana is a true fruit and also a parthenocarpic fruit. Justify.
- *9. Tick the correct option :
(a) Homothallic – Monoecious/Dioecious; Unisexual/Bisexual.
(b) Heterothallic – Monoecious/Dioecious; Unisexual/Bisexual.
10. In the given figure of a fruit, label the part – (a) which is protective in function (b) Which is responsible for producing new plant.



SA - II (2 MARKS)

11. Complete the following with respect to mode of asexual reproduction and their examples
- (a) _____ of *Agave*
 - (b) Rhizome of _____.
 - (c) _____ of *Penicillin*
 - (d) _____ of Sponges.
 - (e) Offset of _____.
12. Internodal segments of sugarcane fail to propagate vegetatively even when they are in contact with damp soil. Why?
13. Differentiate between External and Internal fertilisation.
14. In bisexual self fertilizing plants like Pea, transfer of poller grains to stigma is relatively easy. Why?
15. Dieocious animals must evolve a special mechanism for gamete transfer. Why?
16. Give one example of :
- (a) Exogenous budding
 - (b) Endogenous budding.
17. Match the items in Column A with the items in Column B.
- | <i>Column A</i> | <i>Column B</i> |
|------------------------------|--------------------------|
| (a) Multiple fission | (a) Asexual Reproduction |
| (b) Oestrous cycle | (ii) <i>Plasmodium</i> |
| (c) Menstrual cycle | (iii) Yeast |
| (d) Unequal budding | (iv) Cow, Deer, Tiger |
| (e) Uniparental reproduction | (v) Monkey, Apes, Humans |
18. Higher organisms have resorted to sexual reproduction inspite of its complexity. Why?
19. Give the two parameters of senescence or old age.
20. Organisms exhibiting external fertilisation release a large number of gametes into surrounding medium. Why?
21. Earthworms possess both male and female reproductive organs. What is the name given to such organisms? Give two more examples of such organisms.
- *22. Complete the given table with respect to sexual reproduction in plants and their sites :
- 1. Pollen formation _____.

2. Pollen reception _____.
3. Zygote development _____.
4. Syngamy _____.

*23. Identify each part and write whether it is haploid (n) or diploid (2n).

- | | | | |
|------------|------------------|-------------|----------|
| (i) Sepal | (ii) Branch | (iii) Style | (iv) Egg |
| (v) Pollen | (vi) Male gamete | (vii) Petal | |

24. Note the relationship between the first two words and suggest a suitable word for fourth place :

1. Male flowers : Stamens :: Female Flowers : _____.
2. Grass : Runner :: Potato : _____.
3. Endogamy : Self fertilisation :: Exogamy : _____.
4. Birds : Oviparous :: Primates : _____.
5. *Bryophyllum* : Reproductive leaves :: Water hyacinth : _____.
6. *Rhizopus* : Zoospores :: *Penicillin* : _____.

SA - I (3 MARKS)

25. Differentiate between seasonal and continuous breeders. Give one example of each.
26. Offsprings of Oviparous animals are at a greater risk for survival. Why? How are they different from Viviparous animals? Give one example for each type of animals.
27. Name the three phases of life span. Give the type of proteins which are responsible for transaction between these phases? What is the effect of concomitant changes in the body of an organism during the last phase of life span.
28. Mention the site of zygote formation in the ovule of a flowering plant. What happens to sepals, petals and stamens after fertilisation? State the fate of zygote, ovule and ovary in these plants.
29. Differentiate between Gametogenesis and Embryogenesis.
- *30. Name the blank species a, b, c and d gives in the following table

<i>Organism</i>	<i>Organ</i>	<i>Gamete</i>
a	Testis	Spermatozoa
Human female	b	Ovum
Plant (Angiosperm)	c	Pollen grain
Plant (Pteridophytes)	antheridium	d

LA (5 MARKS)

31. (a) Distinguish between asexual and sexual reproduction. Why is vegetative reproduction also considered as a type of asexual reproduction?
(b) Which is better mode of reproduction : Sexual or Asexual? Why?
32. What are various events in sexual reproduction?

ANSWERS

VSA (1 MARK)

1. Because offsprings produced by Asexual reproduction is morphologically and genetically identical to parent.
2. Adventitious buds arising from notches in the margins.
3. Bamboo – Flowers once in life time, *Strobilanthus* – Flowers once in 12 years.
4. Water Hyacinth (*Eicchornia*).
5. Parthenogenesis.
6. Because only mitotic divisions occur during asexual reproduction.
7. Water.
8. It develops from ovary but without fertilisation.
9. (a) Monoecious, Bisexual. (b) Dioecious, Unisexual.
10. (a) Pericarp (b) Seed.

SA – II (2 MARKS)

11. (a) Bulbil (b) Rhizome (c) Conidia (d) Gemmules
(e) Water Hyacinth (*Eicchornia*).
12. Absence of adventitious buds in the internodal segment
- 13.

<i>External Fertilisation</i>	<i>Internal Fertilisation</i>
(a) Takes place outside the body of organism.	(a) Takes place inside the body of organism
(b) External medium like water is required	(b) External medium not required.
(c) Large number of gametes are produced	(c) Lesser number of gametes are produced.
(d) Organism vulnerable to attack of female.	(d) Organism well protected in the body of female.
(e) e.g. : Amphibiars, Fishes Algae	(e) e.g. : Human being Reptiles, Birds

14. Because anthers and stigma are close to each other.
15. Because male and female gametes are found in different individual.
16. (a) *Hydra*, Yeast (b) *Spongilla*
17. (a) (ii) (b) (iv) (c) (v) (d) (iii) (e) (i)
18. Because of variations, *Gene Pool*, *Vigour* and vitality, Parental care.
19. (a) End of reproductive phase.
(b) Concomitant changes in body like slowing of metabolism.
20. To enhance the chances of Syngamy.
21. Hermaphrodite
Tapeworm, Leech
22. 1. Anther 2. Stigma 3. Embryo 4. Ovule
23. (i) 2n (ii) 2n (iii) 2n (iv) n
(v) n (vi) n (vii) 2n
24. 1. Carpel 2. Stem tuber 3. Cross fertilisation 4. Viviparous
5. Offset 6. Conidia

SA - I (3 MARKS)

25. (a) Mammals which give birth only during favourable season are seasonal breeders e.g.; Dog.
(b) Mammals which give birth throughout the year irrespective of season are continuous breeders e.g. : Human.
26. Since zygote develops outside the body viviparous – Zygote develops into a young one inside the body of female organism.
27. (i) Juvenile phase/Vegetative phase
(ii) Reproductive phase
(iii) Senescence
Hormones, Death
28. Embryo Sac
Sepals, Petals and Stamens dry and fall off. Zygote develops into embryo. Ovule develops into seed and ovary into fruit.

29.	<i>Gametogenesis</i>	<i>Embryogenesis</i>
	1. Formation of gametes	1. Formation of embryo
	2. Produces haploid gametes	2. Embryo is Diploid
	3. Cell division is meiotic	3. Cell division is mitotic
30.	a = Human Male	b = Ovary
	c = Anther	d = Antherozoid

LA (5 MARKS)

29. (a)	<i>Asexual Reproduction</i>	<i>Sexual Reproduction</i>
	(i) Uniparental	(i) Biparental
	(ii) Gametes not involved	(ii) Gametes are involved
	(iii) Only mitotic division takes place	(iii) Meiosis at the time of gamete formation and mitosis after fertilisation
	(iv) Offspring genetically similar to parent	(iv) Offspring different from parent.
	(b) Because in vegetative propagation, characters of parent plants are preserved. Here propagation takes place where new individual arise from vegetative part of parent and have characters similar to that of parent plant.	
	(c) Sexual retrojection introduces variations in offsprings and has evolutionary significance. It helps offsprings to adjust according to the change in environment. It produces better offsprings due to character combination.	
32.	(a) Prefertilisation events – Gametogenesis and gamete transfer.	
	(b) Fertilisation Syngamy.	
	(c) Post fertilisation – Zygote formation, embryo formation.	

For details refer to pages 14, 15, 16, NCERT BOOK.

CHAPTER 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS

POINTS TO REMEMBER

Apocarpous : There are two or more carpels in a gynoecium which are free from each other.

Autogamy : When pollen grains of a flower are transferred from other to stigma of the same flower.

Allogamy : Reaching of pollen grains to the stigma of different plant.

Apomixis : Formation of new individuals through asexual reproduction without involving the formation and fusion of gametes.

Chasmogamous Flowers : Flowers with exposed anthers and stigma.

Cleistogamous Flowers : Flowers which never open.

Coleorhiza : A protective sheath of radicle in monocot seed.

Coleoptile : A protective sheath of plumule in monocot seed.

Endothecium : A fibrous layer is the anther next to epidermis.

Epicotyl : The portion of embryonic axis between the plumule and cotyledon.

Geitonogamy : Self pollination between flowers of the same plant.

Hypocotyl : The region of embryonic axis between the radicle and the point of attachment of the cotyledons.

Micropyle : A small pore in the ovule through which the pollen tube enters.

Monocarpellary Condition : Gynoecium represented by single carpel.

Nucellus : Multicellular tissue in the centre of ovule where embryo sac is present.

Parthenocarpy : Production of seedless fruits.

Polyembryony : Presence of more than one embryo in a seed.

Scutellum : Partially developed single cotyledon of monocot seed.

Syncarpous Condition : Two or more carpels fused together to form a single compound ovary.

Tapetum : Nutritive layer of cells around pollen sac.

Viability of Seed : Ability of seed to retain the power of germination.

MMC : Microspore mother cell.

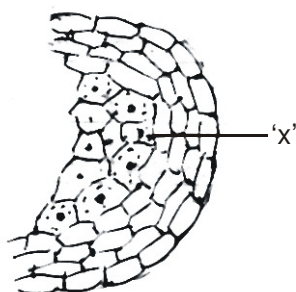
PEN : Primary endosperm nucleus.

PEC : Primary endosperm cell.

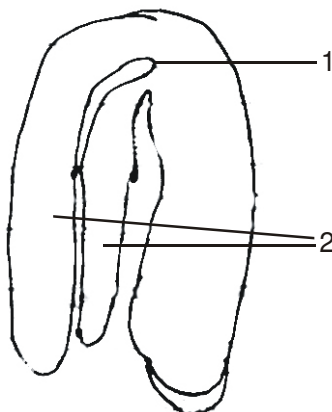
QUESTIONS

VSA (1 MARK)

1. In a young anther, a group of compactly arranged homogenous cells were observed in the centre of each microsporangium. What is the name given to these cells?
2. Give the scientific name of a plant which came to India as a contaminant with imported wheat and causes pollen allergy.
3. In the given figure, give the name and function of the part labelled as 'x'



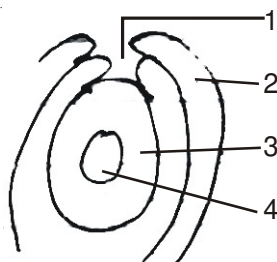
4. The pollen grains are will preserved as fossils. Why?
5. Give the scientific name of an aquatic plant is which pollination and fertilisation take place on the surface of water.
6. Give two example of seeds with persistent endosperm.
7. Give one application of apomictic seeds.
8. What is the name given to the cotyledon in grass family?
- *9. In the given figure of a dicot embryo, label the parts (1) and (2) and give their function.



- *10. If an endosperm cell of argiosperm has 24 chromosome then what will be the number of chromosomes in each root cell?
- *11. Cross pollination in true genetic sense within species is called xenogamy. Why?

SA - II (2 MARKS)

12. One can induce parthenocarpy through the application of growth substances. Which fruit you would select to induce parthenocarpy and why?
13. The flower of brinjal is referred to as chasmogamous while that of beans are cleistogamous. How are they different from each other?
14. Give the ploidy level for :
Nucellus, Megaspore mother cell, Functional Megaspore, Female gametophyte.
15. Give two example where thalamus contributes to fruit formation.
16. Identify the correct labels in argiospermic ovule



17. Give one example for each :
(a) Seed without residual endosperm.
(b) Seed which retains a part of endosperm.

18. Complete :

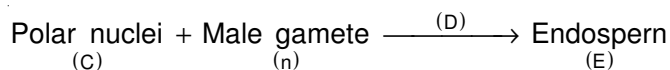
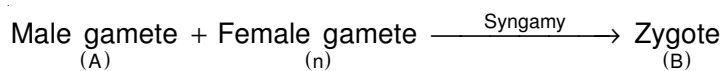
Coconut Water : Free nuclear endosperm/cellular endosperm.

Surrounding White kernel : Free nuclear endosperm cellular endosperm.

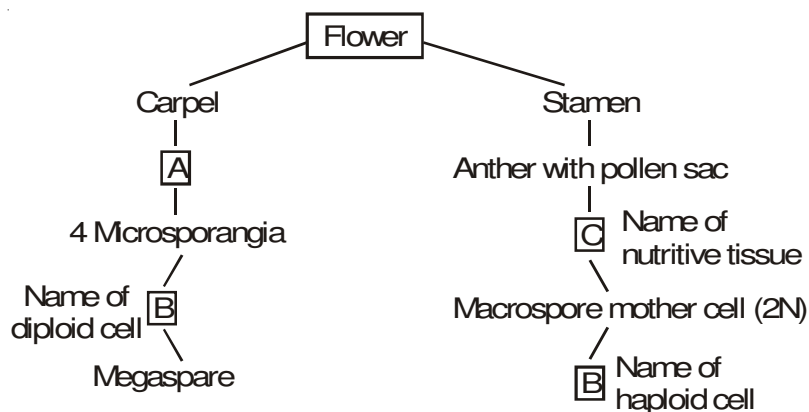
- *19. Even though each pollen grain has two male gametes, why are at least 10 pollen grains and not 5 pollen grain are required to fertilise 10 ovules present in a particular carpel.
- *20. Name the blank spaces a, b, c and d in the table given below :

<i>Item</i>	<i>What it represents in the plant</i>
(i) Pericarp	a
(ii) b	Cotyledon in seeds of grass family
(iii) Embryonal axis	c
(iv) d	Remains of nucellus in a seed.

*21 Give the ploidy of following with respect to angiosperms :



*22 Given below is an incomplete flow chart showing formation of gamete in angiosperm plant. Observe the flow chart carefully and fill in the blank A, B, C and D.



SA - I (3 MARKS)

23. What is unique about the relationship between Moth and Yucca plant in terms of pollination.
24. Give any two characteristics possessed by Anemophilous flowers. What is unique about the poller grains of such plants/flower. Give one example.
25. Continued self pollination leads to inbreeding depression. List three devices which flowering plants have developed to discourage self pollination.
26. Draw a neat diagram of L.S. Maize grain and label any six parts.
27. Differentiate between Epicotyl and Hypocotyl.
- *28. What will be the fate of following structures in the angiospermic plant : Ovary wall, ovule, zygote, outer integument inner integument and primary endosperm nucleus.
- *29. Match the terms in column A with suitable terms in column B.

<i>Column A</i>	<i>Column B</i>
(i) Triple fusion	(a) <i>Vallisneria</i>
(ii) Scutellum	(b) Groundnut
(iii) Parthenocarpy	(c) Primary endosperm nucleus

- | | |
|---------------------------|---------------------|
| (iv) Hydrophily | (d) Red silk cotton |
| (v) Bird pollination | (e) Banana |
| (vi) Non-endospermic seed | (f) Maize |

LA (5 MARKS)

30. (a) With the help of labelled diagrams, depict the stages of microspore maturing into a pollen grain.
- (b) How do the male gametes that are present in the pollen grains reach the ovule and cause double fertilisation.
31. (a) Draw the Embryo Sac of a flowering plant and label :
- (i) Central cell
- (ii) Chalazal end of embryo
- (iii) Synergids.
- (b) Name the cell that develops into embryo sac and explain how this cell leads to formation of embryo sac.
- (c) Mention the role played by various cells of embryo sac.
- (d) Give the role of Filiform apparatus.

ANSWERS

1. Sporogenous tissue
2. *Parthenium*
3. Tapetum
Gives nourishment to developing pollen grains.
4. Because of sporopollenin.
5. *Vallisneria*
6. Castor, Coconut
7. Hybrid vigour is maintained indefinitely.
8. Scutellum.
9. 1. Plumule - to form shoot system.
2. Cotyledons - storage of food.
10. 16

11. Because in cross pollination, resultant hybrid is a combination of characters of two plants.

SA - II (2 MARKS)

12. Grapes, Lemon, Orange, Watermelon (any one example). Such seedless fruits will be of high economic importance.

13. Flower of brinjal is chasmogamous as it has exposed anthers and stigma whereas flowers of bean do not open at all as they are cleistogamous.

14. Nucellus = $2n$, Megaspore mother cell = $2n$ Functional megaspore = n , female gametophyte = n .

15. Apple, Strawberry, Cashew.

16. 1. Micropyle 2. Outer integument

3. Nucellus 4. Embryo sac

17. (a) Pea, Groundnut (b) Wheat, Maize

18. Coconut water – Free nuclear endosperm surrounding white kernel cellular endosperm.

19. Because only one male gamete is involved in syngamy.

20. (a) Wall of fruit (b) Scutellum

(c) Shoot and root tip (d) Perisperm

21. $A = n$, $B = 2n$, $C = n + n$

$D = \text{Triple fusion}$, $E = 3n$

22. $A = \text{Ovule/megasporangium}$

$B = \text{Megaspore mother cell}$

$C = \text{Tapetum}$

$D = \text{Pollen grain}$

SA - I (3 MARKS)

23. Moth → deposits its eggs in the locule of ovary

Flower → gets pollinated by the moth.

24. (a) Flower are with well exposed stamens feathery stigma.

(b) Pollen grains are light and non sticky.

(c) Corn cob, grasses.

25. (a) Release of pollen an stigma receptivity is not synchronised in some plants.

(b) Anther and stigma are at different positions/heights in some flowers.

(c) Self incompatibility.

26. Refer to Fig. 2.15(a) page 37 NCERT.

<i>Epicotyl</i>	<i>Hypocotyl</i>
(a) Portion of embryonal axis above level of cotyledon	(a) Portion of Embryonal axis below level of cotyledn.
(b) Terminate into plumule (stem tip).	(b) Terminates into radical (root tip).

28. Ovary wall = Pericorp; Ovule - Seed. Zygote = Embryo; Outer Integument = Testa, Inner integument = Tegmen.

Primary endosperm nucleus = Endosperm

29. (i) c (ii) f (iii) e (iv) a
(v) d (vi) b

30. (a) Refer to Fig. 2.5 page 23 NCERT.

(b) Through Pollen tube; one of the male gamete fuses with egg cell and other male gamete fuses with polar nuclei.

31. (a) Refer to figure 2.8(c) page 26 NCERT.

(b) Functional Megaspore; Refer Text on page 27 NCERT.

(c) **Egg** : Fuses with male gamete to form zygote or future embryo.

Synergid : Absorption of nutrients, attracts and guides polar tube,

Central Cell : After fusion with second male gamete forms primary endosperm cell which gives rise to Endosperm, (Nutrition).

(d) Guide the entry of pollar tube.

CHAPTER 3

HUMAN REPRODUCTION

POINTS TO REMEMBER

Acrosome : A small cap like extension in the head of sperm head which is filled with enzymes that help in fertilisation.

Blastula : A stage of embryogenesis comes after morula and has a hollow fluid filled space called blastocoel.

Colostrum : Milk produced during the initial few days of lactation. It has several anti-bodies (IgA).

Embryogeny : The development of an organism during embryonic stage.

Endometrium : Inner most glandular layer lining the uterine cavity.

Ejaculation : Expulsion of semen by male.

Foetus : An advanced stage of embryo within the uterus.

Gastrulation : Movement of cells during the development of an embryo at the end of cleavage to form three germ layers.

Gonad : A gamete producing gland – either testis in male or an ovary in female.

Graffian follicle : A fluid filled vacuole containing egg, present in an ovary of mammals.

Gestation Period : A period between fertilisation of ovum and the birth of a baby.

Hymen : A thin membrane partially covering the vaginal aperture.

Implantation : Fixing of embryo/fertilized egg in uterus. It leads to pregnancy.

Insemination : Discharge of semen into the vagina of the female.

Menarche : The beginning of first menstruation in female on attaining puberty.

Menopause : Permanent cessation of menstrual cycle in female. It occurs between the age 45 to 50 years in human female.

Oogenesis : Formation and development of ova in ovary.

Ovulation : Process of release of mature ovum (Secondary oocyte) from the ovary.

Parturition : Process of delivery of the foetess (Child birth).

Placenta : Temporary connection between the foetus and uterine wall of the mother.

Puberty : A stage at which immature reproductive system of boy or girl becomes mature.

Scrotum : A muscular pouch which houses two testes.

Semer : Seminal plasma along with sperms.

Spermatocyte : Diploid cell derived from spermatogonia during meiosis in male.

Spermatogenesis : Formation and development of sperm in testis of male.

Spermiation : Process by which sperms are released from the seminiferous tubules.

Spermiogenesis : Process of transformation of non-motile spermatid into motile sperm.

Stem Cells : Specialised cell which have the potency to give rise to all tissues and organs.

Trophoblast : Outer layer of cells of blastula which absorb the nutrient secreted by uterus membrane.

Zona Pellucida : Non-cellular layer clearly seen around mammalian egg.

ICSH : Interstitial cell stimulating hormone.

GnRH : Gonadotropin releasing hormone.

LH : Luetinising hormone.

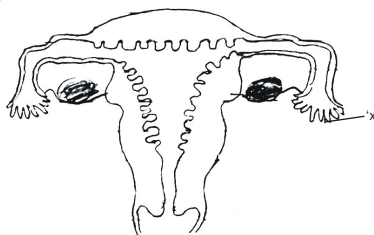
FSH : Follicle stimulating hormone.

hCG : Human chorionic gonadotropin.

hPL : Human Placental lactogen.

VSA (1 MARK)

1. Give the typical terms for birth canal and fertilisation canal.
2. Name the process of rupture of Graffian follicle and the subsequent release of egg from the ovary.
3. Failure of testes to descend into scrotal sacs leads to sterility. Why?
4. In which part of the fallopian tube fertilisation takes place?
5. Drones of honeybee colony are haploids while both workers and queen are diploid. Why?
6. Name the type of immunity produced by : (a) Vaccine; (b) Colostrum
- *7. How many sperm will be produced from 100 primary spermatocytes and how many eggs will be produced from 100 primary oocytes?
- *8. In the given figure, label the part 'x' and also give its function.



*9. Note the relationship between the first two words and suggest a suitable word for the fourth place.

(a) Proliferative phase : Estrogens :: Secretory phase : _____.

(b) Acrosome : Golgi body :: Middle piece : _____.

*10. Mark the odd one out :—

(a) Spermatoocyte; Polar body; Spermatid; Spermatogonium.

(b) Testes; Prostrate; Seminal Vesicle; Cowper's gland.

VSA - II (2 MARKS)

11. What is the name given to the collective secretion of seminal vesicle, prostrate and bulbourethral glands. What is the composition of this secretion?

12. Name two hormones involved in induction of parturition.

13. Give reason for following :

(a) The first half of the menstrual cycle is called follicular phase as well as proliferative phase.

(b) The second half of the menstrual cycle is called luteal phase as well as secretory phase.

14. Give the functions of :

(a) Corpus luteum

(b) Endometrium

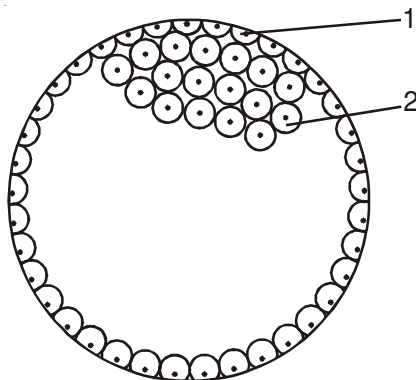
15. Draw a labelled diagram of the fine microscopic structure of a human sperm.

16. Give reasons for following :

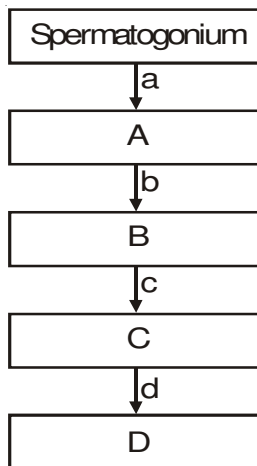
(a) Penetration of sperm into ovum is a chemical process.

(b) Cleavage is also called fractionating process.

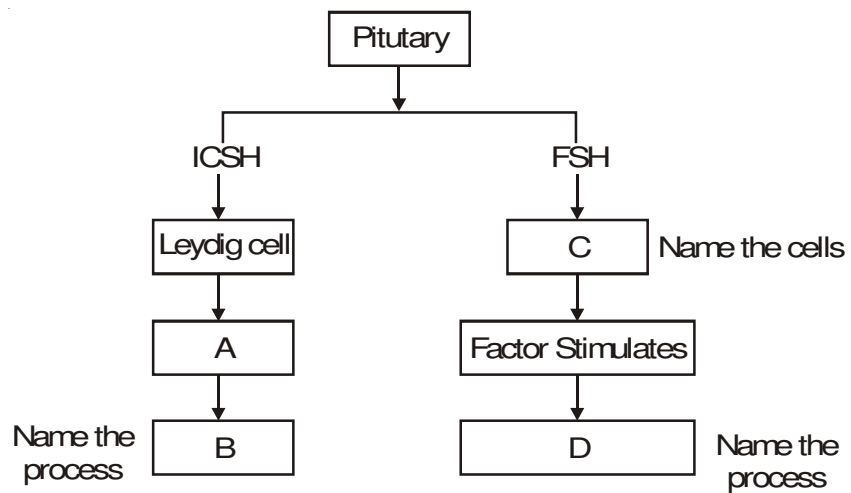
*17. In the given figure, give the name and functions of parts labelled (1) and (2).



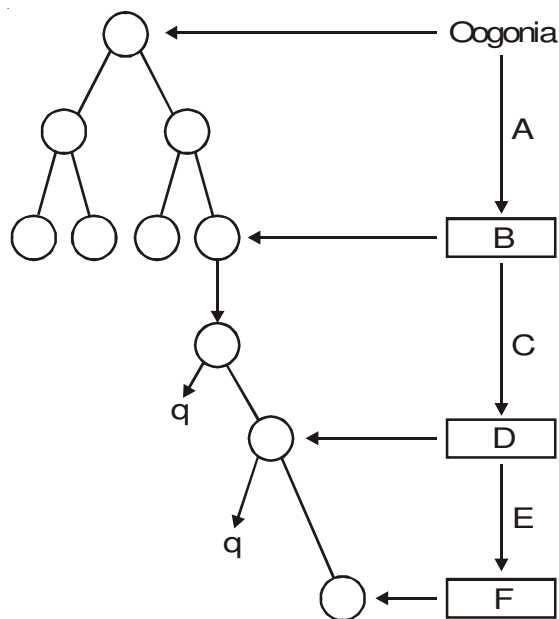
*18. In the given flow chart for sperm formation, fill up A, B, C, D and a, b, c, d.



*19. Given below is an incomplete flow chart showing influence of hormones on gametogenesis in males. Observe the flow chart carefully and fill in the blanks A, B, C, D.



20. Complete the following in the process of Oogeresis.

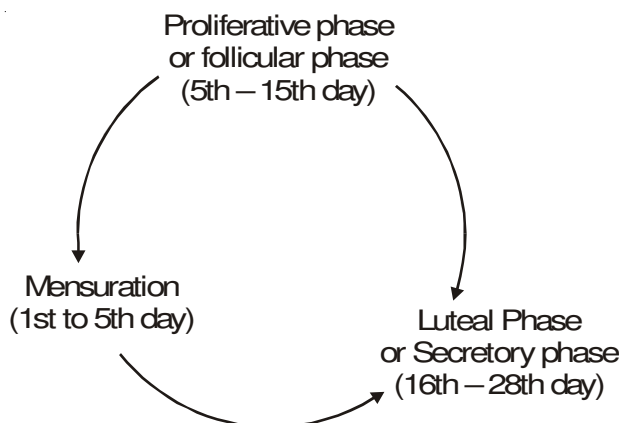


SA - I (3 MARKS)

21. Give the names and roles of hormones involved in regulation of spermatogenesis.
22. Name the act of expelling the full term young one from the mother's uterus at the end of gestation period. Write the missing steps of this neuro endocrine mechanism
- (i) Signals originate from fully developed foetus and placenta.
 - (ii) _____.
 - (iii) _____.

*23. The events of the menstrual cycle are represented below.

Answer the questions following the diagram :



- (i) State the levels of FSH, LH and Progesterone simply by mentioning high or low around 13th and 14th day and 21st to 23rd day.
- (ii) In which of the above mentioned phase does egg travels to fallopian tube?
- (iii) Why there is no mensuration upon fertilisation?

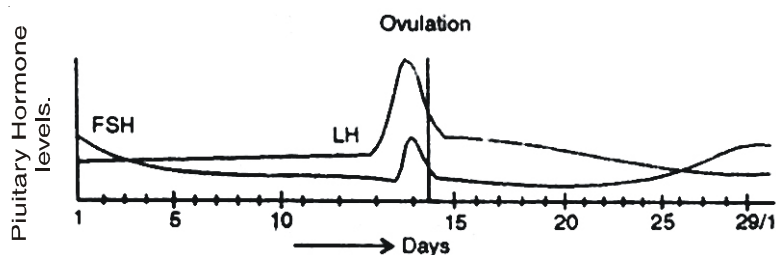
*24. Match the following with correct combinations.

<i>Column A</i>	<i>Column B</i>
(i) Hyaluronidase	(a) Connection of Scrotum with abdomen
(ii) Corpus luteum	(b) Acrosomal Reaction
(iii) Gastrulation	(c) Morphogenetic movement
(iv) Colostrum	(d) Progesterone
(v) Capacitation	(e) Mammary gland
(vi) Inguinal Canal	(f) Sperm activation

*25. (a) Read the graph given below. Correlate the ovarian events that take place in the human female according to the levels of the pituitary hormone during the following day :

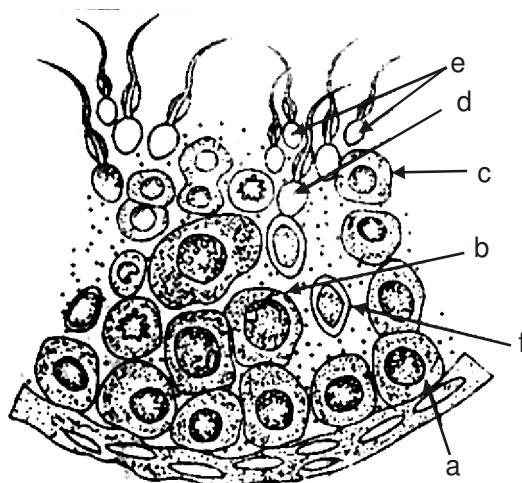
- (i) 10 – 14 days.
- (ii) 14 – 15 days
- (iii) 16 – 23 days.
- (iv) 25 – 29 days (If the ovum is not fertilised).

(b) What are the uterine events that follow beyond 29 days if the ovum is not fertilised?



LA (5 MARKS)

- 26. A woman has conceived and implantation has occurred in uterus. Discuss the sequence of changes upto parturition which take place within her body.
- 27. (a) Draw a sectional view of ovary of human female with the following labels :
Blood vessel, Primary follicle, Ovum, Tertiary follicle, Graffian follicle, Corpus luteum.
- (b) Differentiate between Spermatogenesis and Oogenesis.
- *28. Study the figure given :



- (i) Pick out and name the cells that undergo spermiogenesis.
- (ii) Name 'a' and 'b' cells.
- (iii) Pick out and name the motile cells.

- (iv) What are 'f' cells. Mention their function.
- (v) The above gives diagram represents which structure?

ANSWERS

VSA (1 MARK)

1. Birth canal – Vagina
Fertilisation canal – Fallopian tube
2. Ovulation
3. High temperature of abdomen kills the spermatogenic tissue of the testes so no sperm are formed.
4. Ampullary Isthmic junction.
5. Drones develop parthenogenetically while workers and queen are developed from fertilised and diploid eggs.
6. Vaccine – Active immunity
Colostrum – Passive immunity.
7. 400 sperms, 100 eggs.
8. Fimbriae
Function – Collection of ovum after ovulation
9. (a) Progesterone (b) Mitochondria
10. (a) Polar body (b) Testes

VSA - II (2 MARKS)

11. Seminal Plasma : It has Fructose, Calcium and certain enzymes.
12. Oxytocin, Relaxin
13. (a) During this phase, primary follicles transform into Graffian follicle under FSH stimulation Graffian follicle secrete Estrogens which stimulate enlargement of endometrium of uterus.
(b) During this phase, Corpus luteum is fully formed and secretes large quantity of progesterone.
14. (a) **Corpus Luteum** : It secretes progesterone which prepares endometrium of uterus for implantation, placentation and normal development of foetus.
(b) **Endometrium** : It undergoes cyclic changes during menstrual cycle and prepares itself for implantation of blastocyst.

15. Refer to Fig. 3.6 page 48 NCERT Book.
16. (a) Acrosome of sperm secretes a lytic enzyme hyaluronidase which dissolves vitelline membrane of ovum.
 (b) In cleavage, number of blastomeres increases but size of blastomeres decreases.
17. (1) **Trophoblast** – Gets attached to endometrium and draws the nutritive material secreted by uterine endometrium gland.
 (2) **Inner cell mass** : Differentiates as Embryo.
18. A = Primary Spermatocyte;
 B = Secondary spermatocyte;
 C = Spermatid
 D = Spermatozoa
 a = Mitosis and Differentiation
 b = Ist meiotic division
 c = IInd meiotic division
 d = Differentiation
19. A = Testosterone
 B = Spermatogenesis
 C = Sertoli cells
 D = Spermiogenesis
20. A = Mitosis and differentiation
 B = Primary Oocyte
 C = Ist meiotic division
 D = Secondary Oocyte
 E = Mitosis
 F = Ovum

SA - I (3 MARKS)

21. **GnRH** : Stimulates adenophysis to secrete gonadotrophins.
GSH : Stimulates sertoli cells to secrete factors while help in spermatogenesis.
ICSH : Stimulates interstitial cells to secrete testosterone.
22. Parturition
 (i) Foetal ejection reflex
 (ii) The reflex triggers release of Oxytocin
 (iii) Expulsion of body through birth canal.

23. (i) FSH 13 – 14th day 21st – 23rd day
High Low
LH High Low
Progesterone Low High
- (ii) End of follicular or proliferative phase.
- (iii) Menstruation does not occur during pregnancy upon fertilisation due to high level of progesterone secreted by persisting corpus luteum and Placenta.
24. (i) b (ii) d (iii) c (iv) e
(v) f (vi) a
25. (a) (i) Gonadotropins and FSH increase
(ii) LH attains peak level but FSH decrease
(iii) LH and FSH level decrease
(iv) LH remains low and FSH increases.
- (b) After 29th day there is a menstrual flow involving discharge of blood and cast off endometrium lining.

LA (5 MARKS)

26. Refer subtopic 3.6 (Pregnancy and embryonic development) Page 53-54 NCERT book.
27. (a) Refer figure 3.7 page 49 NCERT book

(b)	<i>Spermatogenesis</i>	<i>Oogenesis</i>
1.	Occurs in testis	1. Occurs in ovary
2.	Spermatogonia change into spermatocyte	2. Oogonia change into oocyte.
3.	Primary Spermatocyte divides to form two secondary spermatocyte	3. Primary oocyte divides to form one secondary oocyte and one polar body.
4.	Spermatogonium forms 4 spermatozoa	4. Oogonia forms only one ovum.

28. (i) Spermatids undergo spermiogenesis
(ii) a = Spermatogonium; b = Primary spermatocyte
(iii) Spermatids
(iv) Sertoli cells – Nutrition to germ cells
(v) It is a part of sectional view of seminiferous tubule of mammalian testis.

CHAPTER 4

REPRODUCTIVE HEALTH

POINTS TO REMEMBER

Amniocentesis : A foetal sex determination test based on chromosomal pattern in amniotic fluid surrounding the developing embryo.

Contraceptive : Any device which prevents fertilisation of ovum.

Coitus : Sexual intercourse.

Condom : A rubber/latex sheath used to cover penis/vagina during coitus.

Mortality : Death rate (number of persons removed from a population by death) at a given time.

Sterilization : A permanent method of birth control through surgery in male or female.

Tubectomy : Procedure of sterilization in human female in which fallopian tubes are cut and tied.

Vasectomy : Procedure of sterilization in human male in which vasa deferentia are cut and tied.

AI : Artificial Insemination

ART : Assisted Reproductive Technologies

CDRI : Central Drug Research Institute

GIFT : Gamete Intra Fallopian Transfer

ICSI : Intra Cytoplasmic Sperm Injection

IMR : Infant Mortality Rate

IUCD : Intra Uterine Contraceptive Device

IVF : In Vitro Fertilisation

MMR : Maternal Mortality Rate

MTP : Medical Termination of Pregnancy

PID : Pelvic Inflammatory Disease

RCH : Reproductive and Child Health care

RTI : Reproductive Tract Infection

STD : Sexually Transmitted Disease

VD : Venereal Disease

ZIFT : Zygote Intra Fallopian Transfer

QUESTIONS

VSA (1 MARKS)

1. Give the term for prenatal diagnostic technique aimed to know the sex of developing foetus and congenital disorders.
2. What is the significance of IUDS.
3. In India, there is rapid decline in infant mortality rate and maternal mortality rate. Why?
4. Where was an oral contraceptive "Saheli" developed?
5. Give any two properties which an ideal contraceptive should have.
6. Correct the following statement :
 - (a) Surgical methods of contraception prevent gamete formation.
 - (b) In Embryo transfer techniques, embryos are always transferred into uterus.
- *7. Birth control pills are called combined pills. Why?
- *8. After a successful in vitro fertilisation, the fertilised egg begins to divide. Where is this egg transferred before it reaches the 8-cell stage and what is this technique called?
- *9. Mark the odd one in each series :
 1. Abortion, Tubectomy, Vasectomy, IUD
 2. Progestins, Condoms, IUD, Cervical caps.
- *10. Note the relationship between first two words and suggest a suitable word for the fourth place :
 - (a) Syphilis : *Treponema pallidum* :: AIDS : _____.
 - (b) IUT : Intra uterine transfer :: ZIFT : _____.

SA - II (2 MARKS)

11. What is periodic abstinence? Explain.
12. Lactational Amenorrhea is a method of contraception Justify. What is the maximum effectiveness of this method in terms of period/duration?
13. How are non medicated IUDS different from hormone releasing IUDS. Give examples.
14. Enlist any four possible ill effects of prolonged use of contraceptives.
15. Write the hormonal combination found in birth control pills.
- *16. Match the terms in Column A with the suitable terms in Column B.

<i>Column A</i>	<i>Column B</i>
1. Tubectomy	(a) Prenatal diagnostic technique
2. Amniocentesis	(b) Oral contraceptive
3. Louise Joy Brown	(c) Cutting of fallopian tube
4. Saheli	(d) Test tube baby

*17. In the table given below, select and enter correct device out of following :

Oral Pill (Saheli), Condom, Copper T, Vasectomy, Tubectomy, Diaphragm, Cervical cap.

<i>Method of birth control</i>	<i>Device</i>
(i) Barrier	
(ii) IUD	
(iii) Surgical Technique	
(iv) Administering hormones.	

*18. Given below are methods (A-D) and their mode of action (a–d) in achieving contraception. Select their correct matching from the option given below :

<i>Method</i>	<i>Mode of action</i>
1. Pill	(a) Preventing sperm reaching cervix
2. Condom	(b) Prevents implantation
3. Vasectomy	(c) Prevents Ovulation
4. Copper T	(d) Semen contains no sperms.

SA – I (3 MARKS)

19. Give another name for sexually transmitted diseases. Name two sexually transmitted diseases which are curable and two sexually transmitted disease which are not curable.

20. Differentiate between Vasectomy and Tubectomy.

*21. Name the techniques which are employed in following cases :

- Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce ova but can provide suitable environment for fertilisation and development.
- Embryo is formed in laboratory in which sperm is directly injected into ovum.
- Semen is collected either from husband or a healthy donor is artificially introduced either into vagina or uterus.

LA (5 MARKS)

22. (a) Differentiate between natural method and barrier method of birth control.
(b) In which age group, the incidences of sexually transmitted disease are reported to be very high?
(c) What preventive measures one has to take to prevent sexually transmitted diseases?
23. What is the name given to the reproductive technologies developed for infertile couples? Give a brief account of various such technologies.

ANSWERS

VSA (1 MARKS)

1. Amniocentesis.
2. Check fertilisation or implantation of blastocyst on the uterus.
3. In India, more and more attention is being given to reproductive and Child Health care (RCH) programme.
4. Central Drug research Institute (CDRI)-Lucknow.
5. (i) User friendly
(ii) Easily available
(iii) Effective but not reversible
(iv) With no or least side effects.
6. (a) Surgical method of contraception prevents gamete motility.
(b) In embryo transfer technique, embryo is transferred into fallopian tube and more than 8 celled embryo is transferred into uterus.
7. These contain synthetic progestins and estrogens which inhibit ovulation from the ovary.
8. Fallopian tube.
ZIFT (Zygote intra fallopian transfer).
9. 1. Vasectomy
2. Progestins
10. (a) Human Immuno deficiency virus.
(b) Zygote intra fallopian transfer.

LA (5 MARKS)

22. (a) Natural Method – Periodic abstinence, withdrawal, lactational anemorrhoea
Barrier Method – Condoms, Diaphragms, Cervical caps, Vaults.
- (b) 15–24 years
- (c) (i) Avoid sex with unknown partner or multiple partners.
(ii) Always use condom during coitus.
(iii) In case of doubt, go to qualified doctor for early detection and get complete treatment.
23. Assisted reproductive technologies (ART) IVF, ZIFT, IUT, GIFT, AI.
Also refer to Page No. 64 NCERT.

CHAPTER 5

PRINCIPLES OF INHERITANCE AND VARIATION

POINTS TO REMEMBER

Allele : Alternative forms of a gene having same locus on chromosome.

Autosomes : All chromosomes other than the sex chromosomes are autosomes.

Aneuploidy : It is the condition of addition or reduction of one or two chromosomes in a homologous pair of chromosomes.

Co-dominance : The alleles which do not show dominance-recessive relationship and are able to express themselves independently when present together *e.g.* I^A and I^B alleles of blood group AB.

Chromosome Mapping : The representation of relative position of genes on the chromosome. The frequency of recombination between gene pairs on the same chromosome is a measure of the distance between genes.

Chromosome Theory : Proposed by Sutton and Boveri. According to this theory – Genes are located on chromosomes and the inheritance and genes is similar to the inheritance of chromosomes.

Down's Syndrome : Genetic disorder caused due to trisomy of chromosome no. 21.

Dominant Allele : The allele which expresses itself in a pair of dissimilar alleles.

Dihybrid Cross : A cross in which two pair of contrasting characters are considered *e.g.* $RRYY \times rryy$ in pea.

Female Heterogamety : A condition where two different types of gametes in terms of sex chromosomes are produced by females *e.g.* In birds female bird produces Z and W gametes.

Genetics : Branch of Biology that deals with the study of reasons behind inheritance and variations.

Gene : Unit of inheritance of characters.

Heterozygous : An individual possessing two different alleles of a gene at a particular locus on homologous chromosome *e.g.*, Tt.

Homozygous : An individual possessing two identical alleles of a gene at a particular locus on homologous chromosome *e.g.*, TT or tt.

Haemophilia : Sex linked recessive disease which shows its transmission from unaffected carrier female to some male progeny due to lack of a blood clotting factors.

Inheritance : It is the process by which characters are passed from parent to progeny making them similar or dissimilar.

Klinefelter's Syndrome : Genetic disorder caused due to additional copy of X chromosome of sex in male resulting in a karyotype of 47 chromosomes (XXY).

Law of Independent Assortment : When two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other.

Linkage : It is tendency of genes present on the same chromosome to inherit together.

Monohybrid Cross : A cross in which a single pair of contrasting characters are considered *e.g.*, TT × tt.

Multiple Alleles : Where more than two alleles given the same character in a population *e.g.*, I^A, I^B and I^O alleles are responsible for blood group.

Male Heterogamety : Condition where two different types of gametes in terms of sex chromosomes are produced by males *e.g.*, In human, male produces X and Y gametes.

Mutation : Sudden, heritable discontinuous variations in organisms due to changes in genes and chromosomes.

Mutagen : Chemical or physical factors that induce mutation *e.g.*, UV radiations.

Phenylketonuria : Inborn error of metabolism inherited as autosomal recessive trait. Affected individual lacks an enzyme that converts amino acid phenylalanine into tyrosine which comes out through urine. Mental retardation occurs as a defect.

Punnet Square : It is a graphical representation to calculate the probability of all possible genotypes of offspring in a genetic cross.

Phenotype : The observable structural and functional traits produced by the interaction of genes and environment.

Point Mutation : Change in a single base pair of DNA *e.g.*, Sickle cell anaemia.

Pedigree Analysis : It is the analysis of a trait in several generations of a family in humans.

Polyploid : An increase in multiple of haploid set of chromosomes in an organism *e.g.*, 3n, 4n, 5n and 6n etc.

Recessive Allele : The allele which is unable to express itself in the presence of the dominant allele but expresses itself in the absence of dominant allele.

Recombination : It is the generation of non-parental gene combinations in the offsprings.

Sex Chromosomes : The chromosomes involved in the determination of sex characters. The last pair of chromosome is generally considered as sex chromosome *e.g.*, XX and XY in humans.

Sex Linked Inheritance : Type of inheritance which is carried from generation to generation along the sex determining genes located on the sex chromosomes.

Sickle Cell Anaemia : Autosomal linked recessive trait, controlled by single pair of alleles Hb^A and Hb^S. Due to substitution of Glutamic acid (Glu) by Valine (Val) at the 6th position of beta globin chain of haemoglobin molecule.

QUESTIONS

VSA (1 MARKS)

1. A pure tall pea plant is crossed with pure dwarf plant. The F_1 progeny is self pollinated. What will be the ratio of true breeding tall plant to true breeding dwarf plant?
- *2. Letter 'D' represents a gene for dominant traits and letter 'd' for its recessive traits. If 'Dd' is crossed with 'Dd', what percentage of offsprings will exhibit dominant traits in next generation?
3. A modified allele is responsible for a non functional enzyme or no enzyme at all. What would be the form of allele of the gene?
4. Name the type of inheritance in which the genotypic ratio is the same as phenotypic ratio.
- *5. A child has been born with 2A + XO chromosomal abnormality. Name the genetic disorder and also mention the sex of the child.
6. A person possess male appearance but have under developed genitalia and gynaecomastia symptoms. Identify the disorder and write chromosomal abnormality of the case.
7. What kind of test will you perform to find out whether the given plant is homozygous dominant or heterozygous?
8. Name the phenomenon in which a gene exists in more than two allelic form.
- *9. The blood group of a mother and her child is 'O'. What will be the expected blood group of her husband?
- *10. Why is human female referred to as homogametic?
- *11. Why is male fruit fly (*Drosophila*) referred to as heterogametic?
- *12. A black dog heterozygous for the colour is crossed with white bitch recessive homozygous. In which ratio, the progeny will show black to white offspring

SA - II (2 MARKS)

13. Few gaps have been left in the following table showing certain terms and their meanings. Fill in the gaps shown at a, b, c and d.

<i>Terms</i>	<i>meanings</i>
(i) Frame mutation	a
(ii) b	generation of non parental gene combination
(iii) locus	c
(iv) d	analysis of traits in a number of generation of a family

14. Distinguish between homozygous and heterozygous taking flower colour in garden pea as an example.
15. How would you correlate the movement and behaviour of chromosomes and genes at meiosis during (1) segregation of an allele pair (2) independent assortment of two genes?
16. Snapdragon show the phenomenon of incomplete dominance. Work out the expected genotypic and phenotypic ratios of a cross between plants with pink flower colour.
17. A child is short statured with small rounded head and protruding tongue and also mentally retarded.
- (a) Name the type of genetic disorder.
- (b) Give the cause for it.
- *18. Why a father is unable to pass on a sex linked gene to his son?
- *19. In human, genetically the sex of the child is determined by the father, not by mother. Explain.
- *20. A haemophilic man is married with a carrier haemophilic women. Still they can have a normal son. Explain.
- *21. On the basis of mechanism of sex determination identify the organism as male and female.

<i>Organism</i>	<i>Sex Chromosomes</i>	<i>Sex</i>
1. Bird	ZW	a
2. Drosophila	XY	b
3. Grasshopper	XO	c
4. Bird	ZZ	d

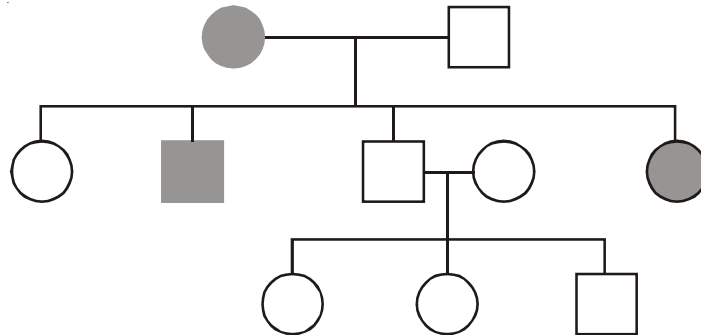
- *22. Study the following Dihybrid cross and complete the gaps a, b, c and d.

P	RRYY	X	rryy
Gametes	RY		a
F1		b	
F2	RY	c	d ry

- *23. The following table shows the genotypes for ABO blood grouping and their phenotypes. Fill in the gaps left in the table.

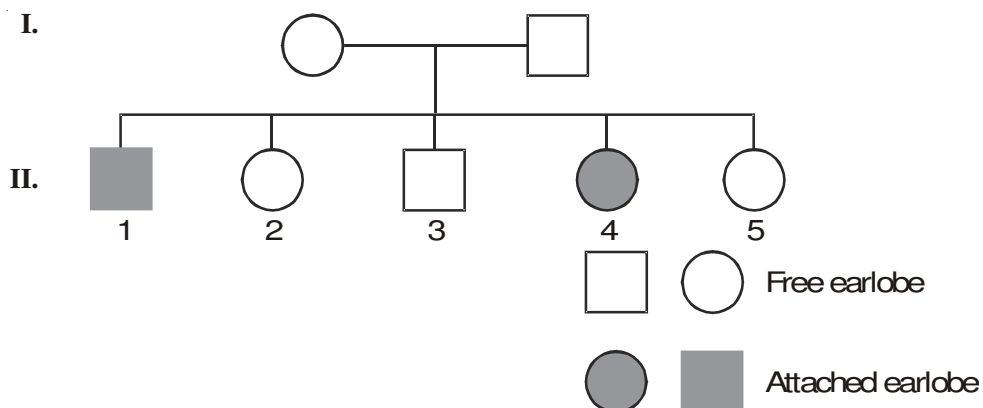
<i>S.No.</i>	<i>Genotype</i>	<i>Blood Group</i>
1.	I ^A I ^A	A
2.	a	A
3.	b	B
4.	I ^B i	B
5.	c	AB
6.	ii	d

- *24. In the following pedigree chart state if the trait is autosomal dominant, autosomal recessive or sex linked. Give a reason for your answer.



SA-I (3 MARKS)

- *25. Draw the symbols used to represent the following in human pedigree analysis.
- Female
 - Affected male
 - Mating between relative
 - 4 unaffected offspring
- *26. Mendel's breeding experiment on garden pea, the F_2 generation yielded offsprings in the ratio of 25% pure yellow pod, 50% hybrid green pods and 25% pure green pods.
- Which pod colour is dominant
 - Write the phenotypes of the individuals of F_1 generation
 - Represent the cross.
- *27. Mention the location of haemophilia gene in human. This disease normally occurs in male and is very rare in female. Give reason.
- *28. Given below is a pedigree chart of a family with 5 children. It shows the inheritance of attached earlobes as opposed to free ones.



- Give the genotype of the parents
- How did you deduce the genotype of the parents?
- What may be the genotypes of child number 5?

- *29. Three persons with aneuploidy defects are given below.
- Monosomic female of sex chromosome.
 - Trisomic male of sex chromosome.
 - Trisomic female of autosomal chromosome.
30. Name the organism on which T.R. Morgan carried out several crosses. Why Morgan selected above organism for his study?
31. A child has blood group 'O'. If the father has blood group 'B' and the blood group of mother is 'A'. Then
- Give the genotype of all three.
 - Find out the expected genotype in the future offspring of this couple.

LA (5 MARKS)

32. Using Punnet square, trace through two (F_1 and F_2) of a dihybrid cross between homozygous round yellow and wrinkled green seed varieties of a pea plant.
- Give the F_2 phenotypic ratio
 - Identify the mendelian principle which has this ratio refers to.

ANSWERS

VSA (1 MARKS)

- 1 : 1
- 75%
- Recessive allele
- Incomplete dominance.
- Turner's syndrome, sterile female.
- Klienefelter's syndome, 44 + xxy
- Test cross
- Multiple allelism / Co dominance.
- A, B and O any
- Because female produces only one type/similar type of gamete i.e., xx.
- Male Drosophila produces two types of gamete 50% with one x-chromosome and 50% with one y-chromosome.
- 1 : 1.

SA - II (2 MARKS)

13. a – deletion and insertion of base of DNA

b – Recombination

c – Site of a gene in a chromosome.

d – Pedegree analysis.

14.	Homozygous	Red flower	RR	Similar alleles
	Homozygous	White flower	rr	Similar alleles
	Hetrozygous	Red flower	Rr	different alleles

15. 1. When homologous chromosomes separate, alleles present on them also segregate.
 2. The homologous chromosomes and so the genes present on them move independently of the other and give rise to 4 combination.

16. Parents Rr X Rr

Gametes		(R), (r)		(R), (r)
			R	r
Progeny	R		RR	Rr
F1	r		Rr	rr

Phenotypic ratio 1 : 2 : 1 Genotypic ratio 1 : 2 : 1
 RR = Red Rr = Pink rr = White

17. (a) Down's Syndrome

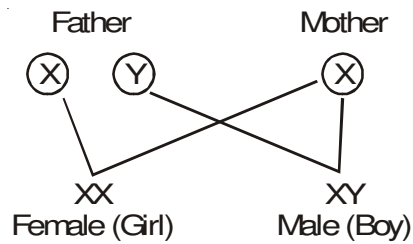
(b) Trisomy of 21st chromosome/Presence of an additional copy of the chromosome number 21.

18. Because gene for sex-linked disease is located on x chromosome. A son (male) receives the 'x' chromosome from mother.

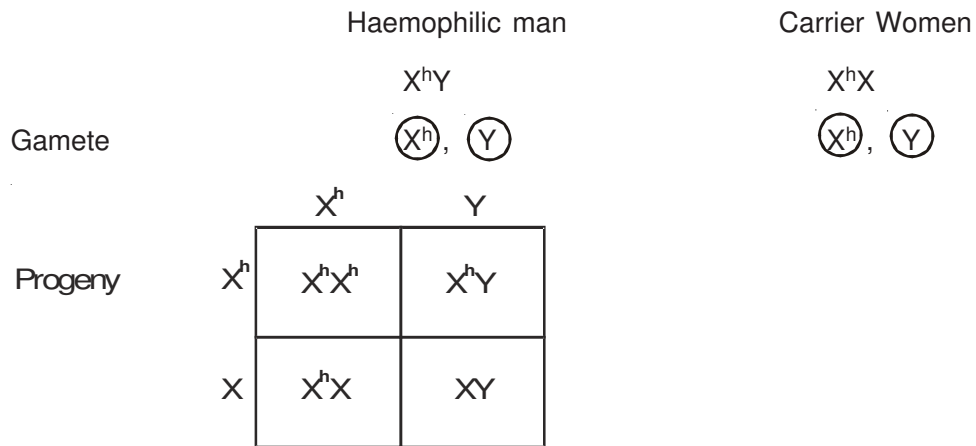
19. Father (Male) has XY chromosome

Mother (Female) has XX chromosome

During fertilisation, one of the father's chromosome (either X or Y) fuse with mother's x chromosome.



20.



X^hX^h = Haemophilic daughter

X^hY = Haemophilic son

X^hX = Carrier daughter

XY = Normal son.

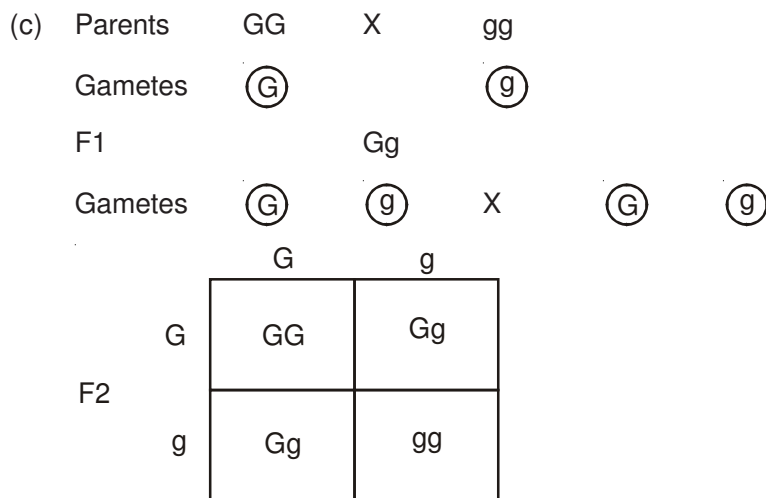
21. (a) Female (b) Male (c) Male (d) Female
22. (a) ry (b) RrYy (c) Ry (d) rY
23. (a) $I^A i$ (b) $I^B I^B$ (c) $I^A I^B$ (d) O

24. Autosomal dominant

defective trait in both male and female progeny/unaffected child did not pass down the trait.

25. Female
- Affected male
- Mating between relatives
- 4 unaffected offspring

26. (a) Green pod colour is dominant
- (b) Green pod colour



Phenotypic ratio 3; 1 Genotypic ratio 1 : 2 : 1

GG = Pure Green Gg = Hybrid Green gg = Pure Yellow

27. Haemophilic gene in human located on X chromosome
 X^hY – Sufferer
 Female will have to recessive allele on both the x chromosome which will be possible only when her father is haemophilic and mother is carrier.
28. (a) Aa
 (b) Since parents have free ear lobes, two of the offspring have attached ear lobes therefore parents will have to be heterozygous.
 (c) AA | Aa.
29. (i) Turner's syndrome XO
 (ii) Klinefelter syndrome XXY
 (iii) Down's syndrome Symptoms – Refer page no. 91 of NCERT book.
30. *Drosophila melanogaster*.
 1. Could be grown on simple synthetic medium.
 2. Life cycle complete in about two week.
 3. Since mating can produce a large number of progeny.
 4. Has many types of hereditary variation.
 5. Clear differentiation of the sexes.
31. (a) Child blood group is 'O' hence genotype is ii (homozygous recessive).
 Parent must be heterozygous i.e.,

CHAPTER 6

MOLECULAR BASIS INHERITANCE

POINTS TO REMEMBER

Anticodon : A triplet in the t RNA complementary to the codon on m RNA.

Bioinformatics : It is a discipline in which database of biological information are created and maintained.

BAC : Bacterial Artificial Chromosome.

Coding Strand : The DNA strand with 5' → 3' polarity which does not code for RNA.

Cistron : Segment of DNA coding for a polypeptide.

Continuous Synthesis of DNA : DNA strand with polarity 5' → 3' where replication is continuous.

Capping : Adding of methyl guanosine triphosphate to the 5' end of hn RNA.

Codon : A triplet nitrogenous base sequence that specifies a single amino acid present on m RNA.

Central Dogma : DNA $\xrightarrow{\text{Transcription}}$ RNA $\xrightarrow{\text{Translation}}$ Protein

Discontinuous Synthesis of DNA : DNA strand with polarity 3' → 5' where replication is discontinuous.

DNA Polymorphism : Variation at genetic level which arises due to mutation.

DNA Ligase : The enzyme that joins the DNA fragments of the discontinuous strand.

Expressed Sequence Tags : Identifying all the genes that are expressed as RNA.

Euchromatin : Region of chromatin which is loosely packed and transcriptionally active.

Frameshift Mutation : Mutation which causes a change in the reading frame from the point of insertion or deletion of base/bases.

Histones : Set of positively charged basic proteins found in DNA.

Histone Octamer : Histones organized to form a unit of eight molecules.

Heterochromatin : Chromatin that is more densely packed, stains dark and transcriptionally inactive.

hn RNA : Heterogenous nuclear RNA; is a precursor of m RNA.

HGP : Human Genome Project.

Intron : Sequences which do not appear in mature or processed RNA.

Inducer : Substrate which regulates switching on of an operon.

Negative Regulation : Regulation of operon by repressor protein.

Nucleosome : The structure formed by the negatively charged DNA wrapped around positively charged histone octamer.

Non-histone Chromosomal Proteins : Set of proteins involved in packaging of chromatin.

Operon : Group of genes making up a regulatory or control unit.

Repetitive DNA : Small stretch of DNA which is repeated many times.

Structural Gene : A gene in an operon that codes for a polypeptide.

Sequence Annotation : Sequencing of the whole set of genome that contains all the coding and non-coding sequences and later assigning different regions in the sequence with functions.

Semiconservative DNA Replication : After completion of replication, each DNA molecule has one parental and one newly synthesized strand.

Splicing : Removal of intron.

SNPs : Single Nucleotide Polymorphism.

Satellite DNA : Bulk genomic DNA.

Transcription : Process of copying genetic information from one strand of the DNA into RNA.

Template Strand : The DNA strand with polarity 3' →5' acts as template for RNA synthesis.

Translation : Process of polymerization of amino acids to form a polypeptide.

Transformation : The phenomenon by which the DNA isolated from one type of a cell, when introduced into another type, is able to express some of the properties of the former into the latter.

VNTR : Variable Number Tandem Repeats.

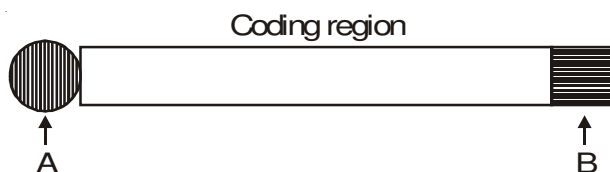
YAC : Yeast Artificial Chromosome.

QUESTIONS

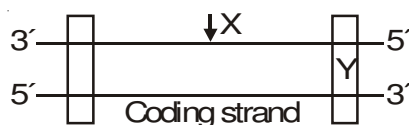
VSA (1 MARK)

1. Name the scientist who first experimentally demonstrated bacterial transformation. Which bacterium was used by him?
2. Which factor of RNA polymerase enzyme recognises the start signals on DNA for transcription process?
3. Which enzyme catalyses the synthesis of a new strand for a DNA molecule by linking nucleotide?
4. Mention the role performed by t RNA during translation.
5. Mention the function of non-histone protein.
6. What is the term used for the regions for a gene which become part of mRNA and Code for the different region of protein?

7. What suitable material is usually taken to extract DNA for performing DNA fingerprinting?
8. Why RNA viruses mutate and evolve faster than other viruses?
9. How do the nucleosome appears in nucleus, where viewed under electron microscope?
10. Why is genetic code said to be degenerate?
11. Name the parts A and B of an mRNA strand give below.



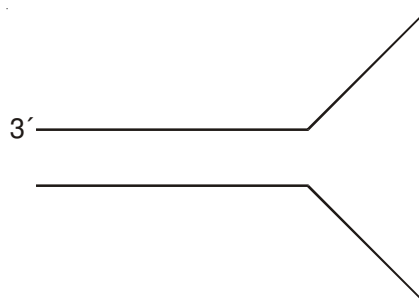
12. Name the parts 'X' and 'Y' of the transcription unit given below.



13. Given below is a sequence of steps of central dogma. Fill up the blank 1 and 2 left in the sequence.



- *14. Regulation of lac operon by repressor is referred to as negative. Why is it so?
15. In which two aspects does the structure of an RNA nucleotide differ from a DNA molecule?
16. Differentiate between euchromatin and heterochromatin.
17. Draw the structure of t RNA for codon AGU on mRNA.
18. Given below a replication fork is represented. Draw the newly synthesized strands and also mention the direction with prime ends.



19. Complete the blanks on the basis of Frederick Griffeth's Experiment.
 S.strain → inject into mice → a
 R.strain → inject into mice → b

S.strain → inject into mice → c

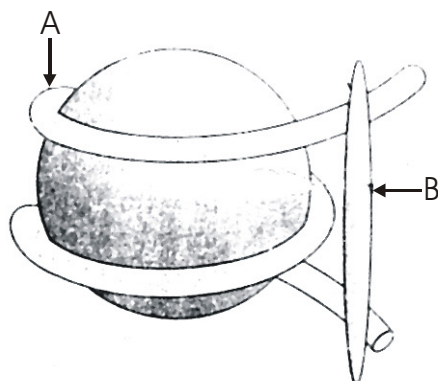
(heat killed)

S.strain (heat killed) → inject into mice → d

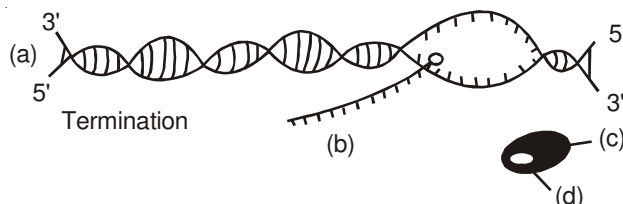
+

R Strain (live)

20. (i) What does the above diagram illustrate?
(ii) Name the parts labelled 'A' and 'B'
(iii) Mention the nature of charge of core part of the molecule.
- *21. The base sequence of one strand of DNA is
5' C A T A G G C T C – 3'
- (a) Write down the base sequence of its complementary strand.
(b) What is the distance maintained between the two consecutive pair of bases in DNA?
22. 'DNA' is a better genetic material as compared to 'RNA'. Why? Explain.



- *23. Why both the strand of DNA do not copied during transcription?
- *24. The process of termination during transcription in a prokaryotic cell is being represented here. Name the label a, b, c and d.



- *25. Distinguish between repetitive DNA and satellite DNA.
- *26. If the length of *E.coli* DNA is 1.36 mm. Calculate the number of base pairs it contains?

SA - I (3 MARKS)

27. Explain the process of splicing, capping and tailing which undergo during transcription in Eukaryotes.
28. Name the three major types of RNAs, specifying the function of each in synthesis of polypeptide.
29. Illustrate schematically the process of initiation, elongation and termination during transcription of a gene in a bacterium.
30. Why is Human Genome Project called a mega project?
31. Enlist four criteria, a molecule must fulfil to act as a genetic material. Name the molecule which acts as genetic material as well as catalyst.
32. Enlist the goals of Human genome project.
33. The base sequence of one strand of DNA is UAC GAT CAT ACT.
 - (a) What will be the base sequence of transcribed mRNA?
 - (b) What specific term is used for the last codon on mRNA?
 - (c) How many amino acid this mRNA transcript can code?
- *34. A tRNA is charged with the amino acid methionine.
 - (i) Give the anti Codon of this tRNA.
 - (ii) Write the Codon for methionine.
 - (iii) Name the enzyme responsible for binding of aminoacid to tRNA.

LA (5 MARKS)

35.
 - (a) Name the scientists who (i) first got very fine X-ray photograph of DNA; (ii) proposed double helical structure of DNA?
 - (b) Write salient features of the double helix structure of DNA.
36. Who first prove experimentally that DNA replication is semi conservative? Name the organism on which experiments were performed. Explain the procedure in detail.
37. Who explained that lactose induced the expression of the genes leading to its catabolism? Show by a schematic representation of the mechanism involved what does the lac operon of *E.Coli* consist of?
38. Describe in brief the process of synthesis of mRNA from DNA in Eukaryotis.
39. There is a paternity dispute for a child. Which technique can solve this problem? Describe the various steps of the technique.
40.
 - (a) Draw the diagram depicting schematically the process of elongation of polypeptide.
 - (b) What is meant by charging of tRNA?
 - (c) How is the translation of mRNA terminated? Explain.

ANSWERS

VSA (1 MARKS)

1. Frederick Griffith
Streptococcus pneumoniae
2. Sigma factor
3. DNA polymerase
4. (i) Structural role
(ii) Transfer of amino acid.
5. Packaging of chromatin
6. Exon.
7. WBC/Hair follicle cell.
8. RNA being unstable mutate faster/2-OH group present, which is a reactive group.
9. as 'beads-on-string'.
10. Because some amino acid are coded by more than one codon.
11. A – Methyl guanosine tri phosphate
B – Poly adenylate tail (Poly A tail)
12. X – Template strand
Y – Terminator
13. 1 – DNA
2 – m
14. When the repressor binds to the operator, the operon is switched off and transcription is stopped.
15. (i) RNA has an additional –OH group at 2' position in ribose sugar
(ii) Uracil present in place of Thymine.
16.

	<i>Euchromatin</i>	<i>Hetero chromatin</i>
(i)	Chromatin is loosely packed and stain light.	Chromatin is densely packed and stain dark.
(ii)	Transcriptionally active	Transcriptionally inactive
17. Refer figure 6.12 Page 114 NCERT book.
18. Refer figure 6.8 Page 107 NCERT book.

19. (a) mice die
(b) mice live
(c) mice live
(d) mice die.
20. (i) Nucleosome
(ii) A – DNA
B – Hi Histone
(iii) Positive Charge
21. (a) 3' G T A T C C G A G – 5'
(b) 0.34 nm
22. RNA has 2'-OH group making it liable and easily degradable (unstable). RNA is a catalyst. So it is reactive while DNA is less reactive and more stable. DNA mutate at slow rate than RNA.
23. Refer page 107 NCERT book, subtopic 6.5.
24. (a) DNA molecule
(b) mRNA transcript
(c) RNA polymerase
(d) Rho factor
25. Repetitive DNA a small stretch of DNA which is repeated many times.

Satellite DNA – The bulk of DNA that forms a major peak and many small peak is called S-DNA. It may be micro and macro satellite and forma large part of human genome.

26. Distance between two basepair = 0.34×10^{-9} m.

Length = Total number of bp \times distance between two consecutive base pair.

$$1.36 \times 10^{-3} \text{ m} = \text{No of bp} \times 0.34 \times 10^{-9} \text{ m}$$

$$\text{No. of bp} = \frac{1.36 \times 10^{-3}}{0.34 \times 10^{-9}} = 4 \times 10^6 \text{ bp}$$

SA – I (3 MARKS)

27. **Splicing** – Removal interon and fusion of exon to form functional RNAs.
Capping – an unusual nucleotide (methyle guanosine triphosphat is added to 5' end of hnRNA).
Tailing – 200–300 adenylates residues are added at 3' end.

28. Types of RNAs :
1. messenger RNA (mRNA)
 2. transfer RNA (t RNA)
 3. ribosomal RNA (rRNA)

mRNA – provides template for polypeptide synthesis.

tRNA – transport the amino acid to the site of protein synthesis.
– recognises the codon on mRNA.

rRNA – plays the structural and Catalytic role during translation.

29. Refer figure 6.10, Page 109, NCERT book.

30. Human genome has approximately 3.3×10^9 b.p. cost of sequencing US \$ 3 per b.p.
Total estimated cost approximately 9 billion US dollars.
- If the obtained sequences were to be stored in typed form in book and if each page contained 1000 letter and each book contained 1000 page, then 3300 book would be needed.
- enormous quantity of data expected to be generated also necessitates the use of high speed computational devices for data storage, retrieval and analysis.
31. (a)1. Should be able to generate its replica.
2. Should chemically and structurally be stable.
3. Should provide scope for slow change.
4. Should be able to express itself in the form of Mendelian character.

(b)RNA

32. Major goals of HGP.

1. Identify all the genes approximately 20000–25000 in human DNA.

For details Refer Page 118 NCERT book.

33. (a) AUG CUA GUA UGA
(b) Stop codon
(c) Three
34. (a) UAC
(b) AUG
(c) Amino acyl – tRNA synthetase.

LA (5 MARKS)

35. (a) (i) Maurice Wilkins and Rosalind Franklin
(ii) James Watson and Francis Crick.
(b) Refer page 97 NCERT book.

36. Scientist – Mathew Meselson and Franklin Stahl.
Organism – *E. Coli*.

Procedure – Medium containing $^{15}\text{NH}_4\text{Cl}$

Centrifugation in CSCI

for detail Refer page 105 NCERT book.

37. Francois Jacob and Jacques Monod. Refer page 117, Figure 6.14, NCERT book.

38. Detail description of :

- Role of three RNA polymerase
- Splicing
- Capping and tailing

Refer Figure 6.11 page 110 NCERT book.

39. DNA fingerprinting.

- Steps –
- Isolation of DNA
 - Digestion of DNA
 - Southern blotting
 - hybridisation using VNTR
- Audiography of hybridised DNA

Refer page 122 NCERT book.

40. (a) Refer figure 6.13 page 115 NCERT book
(b) Amino acid are activated and linked to their cognate tRNA
(c) Refer page 115 NCERT book.

CHAPTER 7

EVOLUTION

POINTS TO REMEMBER

Adaptive Radiation : Process of evolution of different species in a given geographical area starting from common point and radiating to other areas of geography/habitats. It helps in divergent evolution.

Analogous Organs : The organs which have the same functions but are quite different in fundamental structure and embryonic origin e.g.. Wings of insect, bird and bat.

Abiogenesis : Life arising from nonliving molecules.

Biogenesis : Life arising from living molecules.

Convergent Evolution : Form of evolutionary change leading to acquiring similar adaptations for survival in similar habitats.

Divergent Evolution : Development of different functional structures from a common ancestral form according to their adaptive value.

Evolutionary Biology : It is the study of history of life forms on earth.

Fossil : Impression or remains of body parts of organisms of distant past. Which have escaped the process of decay and decomposition.

Founder's Effect : A genetic drift in human population where a population in a new settlement have different gene frequency from that of the parent population. The original drifted population becomes founder.

Gene Pool : Total genes and their alleles of a species in a population.

Genetic Drift : Chance elimination of genes of certain traits from a population due to migration or death.

Homologous Organs : The organs of different species of common descent which perform different functions but have similar basic structure and embryonic origin.

Panspermia : Units of life in the form of so called spores, which were transferred to earth from outer space.

Natural Selection : The selection of individuals with favorable/useful variations by nature.

Saltation : Single step large mutation.

QUESTIONS

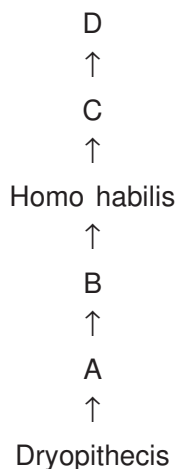
VSA (1 MARK)

1. For a long time, it was believed that life originated from decaying matter. What is this theory known as? Name the scientist who experimentally disproved this theory.
2. Name the Scientist who proposed that first life originated from preexisting nonliving organic molecule (RNA and Protein).
3. Name the Scientist who proposed theory of Mutation. On which plant, he work upon?
4. Give two examples of evolution by anthropogenic action.
5. Evolution of early forms of life occurred in water. Which animal is believed to have evolved into amphibian.
6. How does present day atmosphere of earth differ from Nature of primiline atmosphere?
- *7. In what aspect are the eggs of reptilian different from the Eggs of amphibian?
- *8. Thorns of Bougain Vetaea and tendril of cucurbita and homologous organ. Give one reason in support of your answer.
9. Who gave the concept that population tends to increase geometrically while food supply arithmetically.

SA - II (2 MARKS)

10. Given below are the two pairs of body organs. Categories them as homologous and analogous organs giving reason.
 - (i) Wing of a bat and wing of an insect.
 - (ii) Human arm and flipper of whale.
11.
 - (a) Name the most accepted theory of origin of universe.
 - (b) How was water formed initially?
 - (c) When did the first form of life appear on earth?
12.
 - (a) State hypothesis put forward by oparin and Haldane.
 - (b) Mention the condition present on the primitive earth.
13. Give two examples of impact of continental drift on the evolution of mammals.

*14. Complete the flow chart of human evolution



*15. Few gaps have been left in the following table showing certain terms and their meanings. Fill up the gaps.

<i>Terms</i>	<i>Meaning</i>
(i) a	single state large mutation
(ii) Gene pool	b
(ii) C	The selection of individual with favourable variation by nature
(iv) Adaptive radiation	d

*16. Given below are examples of Plants. Identify these as analogy and homology in Plants.

- (i) Sweet potatoes and Potatoes.
- (ii) Tendril of pea and Tendril of cucurbits.
- (iii) Tendril of cucurbit and Thorn of lemon.
- (iv) Spines of opuntia and tendril of pea.

*17. Distinguish between Darwinian Variation and Hugo deVaries Mutation.

SA – I (3 MARKS)

- 18. Diagrammatically represent S.L. Miller's experiment.
- 19. What is adaptive radiation. Explain taking one example?
- 20. Rearrange the following groups of plants in a ascending evolutionary scale:
Rhynia-type plant, Cycades, Monocot, Gnetales, Chlorophyte ancestor, Dicot.
- 21. S.L. Miller performed an experiment in his laboratory in 1953.
 - (a) What was the aim of his experiment?

(b) Name the gases and source of energy used 'during experiment'.

(c) Name two product formed.

*22. Differential between convergent and divergent evolution giving one example of each.

*23. (i) State the Hardy–Weinberg principle.

(ii) According to this principle, what is the sum total of all allelic frequencies?

(iii) When there is a disturbance in the Hardy–Weinberg equilibrium, what would it result in?

(iv) List the five factors which effect Hardy–Weinberg principle.

*24. 'Industrial melanism' in peppered moth is an excellent example of "Natural selection". Justify the statement.

*25. Fill up the blank left in the table showing Era, period and organism.

<i>Era</i>	<i>Period</i>	<i>Organism</i>
Cenozoic	<u>a</u>	Modern man, Mammals, Birds, rise of monocot
<u>b</u>	Tertiary	rise of first Primate, angiosperm
Mesozoic	<u>c</u>	Ginkago, Genetales
<u>d</u>	Jurassic	Conifers, cycades, Peptiles
Palaeozoic	Permian	Origin of conifer, Lycopodes
Paleozoic	<u>e</u>	Early reptiles (extinct)
<u>f</u>	Silurian	Psilophyton

26. (i) In which part of the world, Neanderthan man lived?

(ii) What was his brains capacity?

(iii) Mention the advancement of Neanderthal man showed over Homo erectus (Javaman).

*27. Figures given below are of Darwin's finches?



Variety of beaks of Darwin's finches.

(a) Mention the specific geographically area where these organisms are found.

(b) Name and explain the phenomenon that has resulted in the evolution of such diverse species in the region.

(c) How did Darwin visited the geographical area?

LA (5 MARKS)

28. Describe the five factors that affects the Hardey–Weinberg’s equilibrium.
29. Trace the origin and evaluation of man in term of Brain size, skeletal structure and dietary preferences.
- *30. Natural selection is an agent of evolution due to which population adapt to their immediate environment. Explain the three type of natural selection along with their diagrammatic representation.

ANSWERS

VSA (1 MARKS)

1. Theory of spontaneous generation.
Louis Pasteur
2. Oparin and haldane
3. Hugo de Vries
evening Primrose (*Oenothera lamarckiana*).
4. Antibiotic resistance microbes
DDT resistant mosquitoes.
5. Lobe finned fish (*Latemaria*).
6. Present day atmosphere is ‘oxidising’ in nature.
Primitive atmosphere was ‘reducing’ in nature.
7. Reptiles lay thick shelled eggs which do not dry up in sun like those of the amphibians.
8. Both are modification of stem (axillary bud).
9. T.R. Mathus.

SA - II (2 MARKS)

10. (i) Analogous organs – Same function but different origin and development plan.
(ii) Homologous organs – Same origin and development but different functions.
11. (a) Big bang theory
(b) O₂ combine with ammonia and methane to form water.
(c) 4 billion years ago.
12. (a) ‘Formation of life preceded by chemical evolution’.

- (b) High temperature, volcanic eruptions, reducing atmosphere with methane and Ammonia gases.
16. (i) analogy
(ii) analogy
(iii) homology
(iv) homology
14. A – Rama pithecus
B – Austra lopithecus
C – Homo erectus
D – Homo sapiens
15. (a) a – saltation
b – Total genes and their alleles of a species in a population
c – Natural selection
d – The process of evolution of different species in a given geographical area starting from a point and radiating to other area.
13. **Ex. 1** : Due to continental drift, when South America joined North America, the mammals like horse, rabbit etc. that lived in South America were over–ridden by the mammals of North America.
Ex. 2 : The pouched mammals of Australia flourishing due to lack of competition from any other mammals.

17.

<i>Hugo deVaries Mutation</i>	<i>Darwinian Variations</i>
1. Mutations are large differences in the characters of organism, that appeared suddenly.	1. Variations are minor changes in the character among the individual of a species.
2. Mutation Caused speciation in a single step.	2. Evolutions of Darwin was gradual change spanning over a no of generation.

SA – I (3 MARKS)

18. Refer Fig. 7.1 page 128 NCERT book.
19. Define : See point to remember
Ex. : Marsupial or placental mammals in Australia or Darwin's finches Refer page No. 133 NCERT book.
20. Chlorophyte ancestors Rhynia type plantsCycads Gnetales Dicot Monocat.

21. (a) To prove oparin's theory of origin of life.
(b) Gases taken – methane, Ammonia, Hydrogen and water Vapour.
Energy – Electric spark from electrodes and heat.
(c) Aminoacids and Sugar.
22. Convergent Evolution : Ex. – Tuber of Potato and sweet potato
Divergent Evolution : Ex. – Wings of bird and hands of man.
For details Refer page 131 NCERT book.
23. (i) The allelie frequency in a population are stable and is constant from generation to generation.
(ii) Cone
(iii) Evolution
(iv) Gene migration, genetic drift, mutation, genetic recombination and natural selection.
24. Refer Page 131, NCERT book.
Ex. of white wingedmoth and Dark Winged moth from Singland before and after industrialisation.
25. a – Quaternary
b – Coenozoic
c – Cretaceous
d – Mesozoic
e – Carboniferous
f – Paleozoic
26. (a) near East and Central Asia
(b) 1400 c.c.
(c) Much more brain capacity as compared to Homoerectus (900 c.c.)
 They used hides to protect their body.
 They buried their dead.
27. (a) Galapagos island
(b) Adaptive radiation
Refer page 133 NCERT book.
(c) Through Sea Voyage in a sail ship called H.M.S. Beagle.

LA (5 MARKS)

28. Refer Page 137 NCERT book.

29. Refer Page 140 NCERT book.

30. Stabilising Natural selection.

Directional Natural selection.

Disruptive Natural selection.

Refer Page 136 NCERT book.

CHAPTER 8

HUMAN HEALTH AND DISEASE

POINTS TO REMEMBER

Acquired Immunity : Immunity acquired by an individual after birth. It is stored in memory cells and activated as primary immune response and continue as secondary immune response.

Active Immunity : The immunity produced by an individual after undergoing primary immunity response. It is specific and generates memory cells for future. Its generation takes longer time *e.g.*, against polio, small pox, chicken pox and cholera etc.

Addiction : A psychological attachment to certain effects such as euphoria and temporary feeling of well-being—associated with drugs or smoking or alcohol.

Adolescence : Period of accelerated growth extending between childhood and adulthood.

Allergen : A (non-self) foreign substance inducing allergy. It may be anything like pollen, dust, certain medicines, smoke or cold etc.

Allergy : A hypersensitive response to an antigen showing undesirable symptoms like rashes, itching, redness, regular sneezing and watering of eyes. It can be controlled by anti-allergic chemicals like histamine etc.

Amoebiasis : Dysentery (quick, repeated defecation) caused by secretion of protozoans like *Entamoeba histolytica*.

Alcoholic : Alcohol dependent person.

Analgesics : Pain killer chemicals.

Anamnestic Response : Vigorous secondary immune response to the same pathogen (antigen) after primary immune response It is due to active role of memory cells. The rate of proliferation of antibodies and lymphocyte cells is very fast.

Antigens : Foreign (non-self) substances which stimulate production of antibodies.

Antibodies : Glycoproteins (Immunoglobulins) produced by B-lymphocyte in blood counteract the toxins or antigen of pathogens.

Antibiotics : Chemical substances derived from micro-organisms and used against other pathogenic micro-organisms *e.g.*, penicillin and streptomycin.

Anaphylaxis : Rapidly developing reverse allergic reaction that may occur in all tissues.

Auto Immunity : An autoimmune disorder caused when the body's immune system goes off the track and starts destroying self cells and molecules.

Benign Tumor : Cancerous growth in the state of non-proliferation or non growing cancer (*i.e.*, confined to their original location and do not spread).

Biopsy : Examination of a living tissue after being cultured to discover the cause/presence/extent of cancer.

B-lymphocytes : A type of agranular leucocytes (WBCs) produced and matured in bone marrow and take part in humoral immunity by producing antibodies.

Cannabinoids : Group of chemicals obtained from resin, inflorescence/flower top or leaves of *Cannabis Sativa* (hemp), e.g., marijuana, hashish, ganja and charas.

Carcinogens : Cancer causing agents. e.g., gamma rays. UV rays, cosmic radiations, soot, aniline dyes and lead compounds etc.

Cell Mediated Immunity : Immunity mediated by T.lymphocytes when certain WBCs do not produce antibodies.

Cirrhosis : A liver disease due to excessive storage of fats.

Colostrum : A concentrated, yellowish milk produced by mother during initial days of lactation, containing abundant antibodies which provide passive immunity in child.

Congenital Disease : Genetic and inheritable disease which is present at the time of birth in child.

Depressants : Chemicals which lower the activity of CNS e.g., alcohol, opiates.

Disease : A malfunctioning of certain body organs and impairment of health.

Drug : Chemical which is taken on the advice of some physician.

Hallucinogens : Chemicals which cause hallucination (seeing objects which are not present) e.g., LSD.

Health : A state of complete physical, mental and social well-beings.

Humoral Immunity : The immunity which consists of antibodies produced by B-lymphocytes in response to the antigens.

Immunity : Resistance to infection or non-self substance (antigen).

Immuno Suppressant : The chemical which suppresses the immunity response to antigen partially or completely.

Inflammation : Response of body tissue to injury or infection characterized by symptoms like heat, swelling, redness, pain, vasodilation or increased capillary permeability.

Innate Immunity : Non-specific immunity present at the time of birth. It is inheritable and acts like barrier to the pathogens.

Interferon : The glycoproteins produced by our body cells in response to a viral infection.

Incubation Period : The time period between infection and the appearance of symptoms.

Lysozyme : Enzyme that destroy the cell walls of many bacteria.

Lymphoid Organs : Organs of body where WBCs are produced, mature, store and work. e.g. Primary-bone marrow and thymus gland; Secondary-spleen, tonsils, lymph nodes and MALT lining etc.

Malignant Tumor : The masses of neoplastic/proliferating cells, which grow rapidly, invade and damage the surrounding normal cells/tissues.

Metastasis : The phenomenon in which the cancer cells spread to different sites through blood fluids and develop secondary tumours.

Oncogenes : Viral genome which causes cancer. After viral infection, host genome goes off the track and cells become cancerous.

Opioids : The drugs like morphine, cocaine, heroin (smack) etc. which bind to opioid receptors in the CNS and gastrointestinal tract.

Opiates : Chemicals derived from opium.

Passive Immunity : The antibodies developed in other vertebrates in response to deliberate inoculation of antigen in the body. Its effect is faster but stays for a short period *e.g.*, immunity given by tetanus antitoxin or antibodies in colostrum.

Psychotropic Drugs : Chemicals which change behaviour and perception power (mood) of individuals.

Retrovirus : A virus having RNA as genetic material and forms DNA by reverse transcription and then replicate *e.g.*, HIV.

Reverse Transcriptase : Enzyme which forms DNA from RNA (template) in retrovirus (RNA virus).

Sedatives : Chemicals which decrease the activity of CNS *e.g.*, alcohol.

Sporozoites : The infective stage of protozoa *Plasmodium* which is injected into human blood through saliva of female *Anopheles* mosquito.

Syndrome : Collection of disease symptoms responsible for genetic disorder.

T-Lymphocytes : A type of agranular leucocytes (WBCs) which are matured in thymus gland and take part in cell mediated immunity.

Tissue Typing : The procedure carried out to match HLA proteins of donor and recipient.

Vaccine : Inactivated/weakened or dead pathogens used for vaccination.

Vaccination : Inoculation of a vaccine to stimulate production of antibodies and provide immunity for one or more disease.

Withdrawal Symptoms : The characteristic unpleasant symptoms manifested by the body of a drug addict, if regular dose of drug is abruptly discontinued. *e.g.*, anxiety, shakiness, nausea and sweating etc.

ABBREVIATIONS

AIDS : Acquired Immuno Deficiency Syndrome

CMI : Cell Mediated Immunity

ELISA : Enzyme Linked Immunosorbent Assay

HIV	:	Human Immunodeficiency Virus
HLA	:	Human Leukocyte Antigen
MALT	:	Mucosal Associated Lymphoid Tissue
SCID	:	Severe Combined Immuno Deficiency
NACO	:	National AIDS Control Organisation
MRI	:	Magnetic Resonance Imaging
LSD	:	Lysergic Acid Diethylamide

QUESTIONS

VSA (1 MARK)

1. Name the disease in which the immune system of the body of a patient is suppressed. Also give the name of its causative agent.
2. In attaining specific immunity, two major groups of cells are required. Give the names of these two groups.
3. The lymph system in our body is linked with immunity. How?
4. The pathogen of a disease depends on haemoglobin for its growth. The patient suffers from bouts of shivering and high fever. Name the disease, patient is suffering from and the pathogen.
5. At what stage of malignant cancer, the cell proliferate and move to other parts of the body?
6. Give the reasons for the following statements :
 - (i) Communicable (infectious) diseases are more common than non-communicable diseases.
 - (ii) Breast fed babies are more immune to diseases than the bottle-fed babies.
 - (iii) All new tobacco products manufactured in India (after 1.6.2009) will have to carry pictorial (scorpion and lung symbols) warning.
 - (iv) Alcoholism generally leads to deficiency of vitamin A in the Alcoholics.
 - (v) Barbiturates and alcohol should not be used simultaneously.
- *7. Benign tumour is less serious than metastatic cancer. Why?
- *8. Why is passive immunity short lived?
- *9. What is meant by drug abuse?

S.A. - II (2 MARKS)

10. Write four major methods of taking drugs by an addict.
11. How does HIV results in reduced immunity?

12. Modern lifestyle leads us towards lethargic, unhealthy body. Suggest four ways to attain good physical and mental health.
13. Name two organs of our body where the defence cells are matured also name the organs where they perform action.
14. Write the principle of vaccination on which active immunity works.
15. Write various techniques used for detection of cancer.
16. What is Typhoid Mary?
17. State any two properties of cancer cells that distinguish them from normal cells.
18. Differentiate between primary and secondary immune response.
19. Differentiate between B-lymphocytes and T-lymphocytes.
20. Bring out the effects of alcohol on our body.

SA – I (3 MARKS)

21.
 - (i) What is meant by addictive disorder?
 - (ii) Name any two opiate narcotics.
 - (iii) Mention any two ways how opiate narcotics affect human body.
22. Fill in the blanks in the different columns of the table given below, to identify the Nos. 1 to 8.

Disease	Causal Organism	Mode of transmission/carrier	Symptoms
1. Typhoid	.....1.....	.....2.....	Sustained high fever fatigue Headache, stomach perforations
2. ....3.....	<i>Streptococcus pneumoniae</i>	.....4.....	Alveoli filled with water, reduced breathing, fever chills, cough
3. ....5.....	.....6.....	bite of female mosquito	Show chronic inflammation of organs, lymph vessels of lower limbs swell.
4. Ringworm	.....7.....	.....8.....	Dry Scaly lesions on various body parts, intense itching, redness.

23. A man lives with his wife happily who is an AIDS patient. What precautions are they possibly taking so that the husband is safe from the dreaded disease. Mention other ways by which this female can transmit HIV to other members.
24. Draw a labelled diagram of an antibody molecule.
25. Mention any six factors that are important/necessary to achieve good health.
26. Name two diseases each, which are transmitted in the following ways :
 - (i) Through contaminated food and water

- (ii) Through insect vectors
 - (iii) Through air/droplet inhaled.
27. Enumerate the steps taken by WHO to control AIDS. Mention the category of people who are at high risk of getting this disease.
 28. Mention some causes for drug abuse.
 - *29. AIDS is transmitted from mother to the foetus through placenta in the womb (uterus) then why do we call it non-congenital or acquired disease?
 - *30. A person shows strong unwelcome immunogenic reactions while exposed to certain substance. Name this condition and common term for such substance. Give two such substances and two symptoms. Name the lymphocytes responsible for such reactions.

LA (5 MARKS)

31. Describe the life cycle of *Plasmodium*. Draw a schematic diagram showing the life cycle of *Plasmodium*.
32. Describe the different methods of treatment, cause and methods of detection of cancer.
33. Enumerate different measures for control and prevention of drug/alcohol abuse among adolescents. Mention the reasons why adolescents attract towards drug/alcoholism.
34. Represent schematically/diagrammatically the life cycle of HIV.
35. Discuss the different barriers of our innate immunity.
36. Explain how HIV infects human body.

ANSWERS

VAS (1 MARK)

1. AIDS, HIV (Human Immuno Deficiency Virus)
2. B-Cells and T-Cells
3. Immunity occurred due to maturity of WBCs and differentiation and transported through lymph system.
4. Malaria, *Plasmodium*
5. Metastasis
6.
 - (i) Because communicable diseases spread from an infected person to a healthy person, while non-communicable diseases remain confined to the affected person.
 - (ii) Breast-fed babies get readymade antibodies *e.g.*, (IgA) alongwith the mother's milk while such antibodies are not available to bottle-fed babies.

- (iii) To discourage the use of tobacco products as they cause heart and blood vessel diseases, cancer, respiratory disorders and adverse reproductive effects.
 - (iv) Alcohol causes liver damage called cirrhosis. As liver is the site of synthesis of vitamin A so in cirrhosis there will be deficiency of vitamin A.
 - (v) These are known to impair vision and judgement of distance, so increase of chances of road and industrial accidents.
7. The benign tumour remains confined in organ affected as is enclosed in a connective tissue sheath and does not enter the metastatic stage.
- *8. Because the injected antibodies do not stimulate the immune cells to produce more antibodies.
- *9. When drugs are taken for a purpose other than their normal clinical use and in amounts/concentrations or frequency that impair one's physical, physiological and psychological functions.

SA - II (2 MARKS)

10. (i) Intravenous injection (ii) Snorting
(iii) Smoking (iv) Oral Consumption
11. HIV destroys CD-4 (helper T. lymphocytes). So CMIS (Cell Mediated Immune System) is not able to activate.
12. (i) Balanced diet (ii) Proper personal hygiene
(iii) Regular exercise (iv) Yoga
(v) Proper rest/sleep.
13. (i) Bone marrow and thymus gland
(ii) Tonsils and lymph nodes
14. Weakened/inactivated pathogenes or antigens are inoculated in the body
 Body develops immunity (humoral/cell mediated) against antigen.
 Antigens are destroyed by primary response and memory cells remain there for secondary response to counteract.
15. Tissue biopsy, Radiography (X-Ray or CT-Scan), MRI and WBC count for leukemia (blood cancer).
16. 'Typhoid Mary' is a classic case in medicine.
 Mary Mallon was a cook by profession and was a typhoid carrier.
 She continued to spread typhoid for several years through the food she prepared.
17. (i) They show uncontrolled proliferative ability with a reduced requirement for extracellular growth factors.
(ii) Have the ability to move in the body fluids to distant sites (metastasis).

- (iii) Have the ability to resist induction of cell death.
18. **Primary Immune Response** : It occurs as a result of first encounter of animal with an antigen, takes longer time to establish and declines rapidly.
- Secondary Immune Response** : It occurs at the second and subsequent encounters of the animal with the antigen, more rapid and lasts for longer periods.
19. B-lymphocytes undergo maturation in the bone-marrow, produce antibodies against the antigen and do not respond to organ transplants. T-lymphocytes mature in thymus gland, either directly attach the antigens or stimulate the B-cells to produce antibodies and react to organ transplants.
20. Alcohol causes liver cirrhosis
- Makes the reaction time longer and judgement poor.
- Causes deposition of fats in the liver.
- Affects the cerebellum and impaired co-ordination of muscles.

SA – II (3 MARKS)

21. (i) 'Addictive disorder' is the state when the body requires a continuous presence of a polychotropic substance within it.
- (ii) Morphine, heroin, pethidine etc.
- (iii) Opiate Narcotics – Suppress brain function and reduce anxiety and tension.
- relieve intense pain.
- produce feeling of well-being.
22. 1. *Salmonella typhi* (bacteria), 2. Contaminated food/water/housefly, 3. Pneumonia, 4. Droplet infection via coughing, sneezing, 5. Filariasis/elephantiasis, 6. *Wuchereria bancrofti*, 7. *Microsporium trichophyton*, 8. Contaminated soil, clothes, comb.
21. By using condom during sexual intercourse.
- The transmission of disease may be caused if her blood is donated to a needy person, pregnant mother to her foetus or using of syringe (injection needle) used by her.
24. Refer Fig. 4, Page 151 of NCERT Text Book.
25. (i) Awareness about diseases and their effects on different body functions.
- (ii) Vaccination/immunisation against many infectious disease.
- (iii) Control of vectors
- (iv) Proper disposal of wastes/excreta.
- (v) Periodic cleaning and disinfecting of water reservoirs, tanks etc. to avoid water borne diseases.

- (vi) Consumption of clean food and drinking water.
 - (vii) Exercise and relaxation
26. (i) Typhoid, Polio, Amoebiasis
- (ii) Filariasis, Malaria
- (iii) Pneumonia, Common Cold
27. Ensuring use of disposable needles and syringes
- Checking blood for HIV.
- Free distribution of condoms and advocating safe sex.
- Controlling drug abuse.
- Promoting regular checkup for HIV in susceptible cases.
28. (i) Curiosity (ii) Need for adventure
- (iii) Excitement (iv) Experimentation
- (v) To escape from stress (vi) Unsupportive family structure
- (vii) With repeated use of drugs/alcohol
- *29. Biological birth starts at zygote formation.
- Infections acquired after zygote formation do not belong to the category of congenital disease.
- Its defective gene is not inherited from parent as that happens to be in congenital disease.
- *30. Allergy
- Allergen
- Continuous sneezing/eye watering
- Mast Cells.

LA (5 MARKS)

31. The Sporozoites enter the body, reach the liver through blood and multiply within the liver cells.
- Liver cells burst and release the parasites into blood.
 - Parasites attack new RBCs, multiply and cause their rupture.
 - Rupture of RBCs cause release of toxin sporozoin which is responsible for high fever with shivering.
 - Sexual stages (gametocytes) develop in RBCs.
 - Parasite enters in the stomach of female *Anopheles* mosquito, along with the blood of infected person.

- In further development, the gametes fuse to form a zygote, which forms sporozoites.
- The sporozoites are transported to salivary glands and stored there for further transfer to another human body during mosquito bite.

Ref. Fig 8.1, Page 148, NCERT Text Book of Biology XII

32. Cancer may be caused due to carcinogens which are physical (radiations), chemicals (Nicotine, Aflatoxin, Cadmium Oxide, Asbestos etc.) and Biological (Viral oncogenes).
- Cancer can be diagnosed/detected by biopsy and histopathological studies, blood and bone marrow tests, radiography, MRI, C.T. Use of antibodies against cancer specific antigens.
- In treatment of cancer the radiotherapy, chemotherapy, immunotherapy or surgical removal of tumour cells can help.

33. (a) Reasons to attract/tend towards drug abuse or alcoholism

- Peer Pressure
- Curiosity
- Escape from frustration and failure
- Family history
- False belief of enhanced performance.

(b) Preventive measures : by avoiding undue peer pressure :

- by educating and counselling to face problems and stresses and to accept failures and disappointments as a part of life.
- by seeking help from parents and peers.
- looking for danger signals—initiating proper remedial steps/treatment at an early stage.
- seeking professional and medical help for de-addiction and rehabilitation programmes.

34. Ref. Figure 8.6, Page 155 NCERT Text Book of Biology.

35. (i) **Physical Barriers** : Skin, mucous-coated epithelium of respiratory, digestive and urinogenital tracts.
- (ii) **Physiological Barriers** : Acidity of stomach, lysozyme in saliva, tears, sweat etc.
- (iii) **Cellular Barriers** : Macrophages, Neutrophils, Monocytes and natural killer lymphocytes.
- (iv) **Cytokine Barriers** : Interferons produced by viral infected cells protect the non-infected cells from further viral infection.

36. HIV attacks a macrophage, its genomic RNA enters the host cell.

- ❑ Genomic RNA forms its complimentary DNA in the presence of enzyme reverse transcriptase and host machinery.
- ❑ Complimentary DNA incorporates with the host DNA.
- ❑ Viral DNA forms proteins and genomic viral RNA.
- ❑ Viral RNA and protein integrates together.
- ❑ They are liberated with the lysis of helper T-cells.
- ❑ The released viral particles start infecting other healthy helper T-cells.
- ❑ Helper T-cells get reduced and lead to AIDS symptoms.
- ❑ Patient get susceptible to microbacterium infections.

CHAPTER 9

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

POINTS TO REMEMBER

Animal Husbandry : Science of rearing, feeding, caring and breeding of livestock. It also includes poultry, farming and fishery.

Apiary : An apiary is a place where beehives are kept in wooden chambers (artificial) to get honey and other products of bee.

Apiculture : Rearing of honey bees for increased production of honey, bee's wax, propolis, royal jelly and bee venom. *Apis mellifera* is commonly used for production of honey on commercial basis.

Artificial Insemination : Introduction of semen of good quality of male into the vagina of another female.

Aquaculture : It pertains to the production of useful aquatic plants and animals such as fishes, prawns, crayfish, mussels, oysters and seaweeds by proper utilization of available water.

Allele : It refers to one of the alternative forms of a gene. In most organisms there are two alleles- Dominant and Recessive.

Blue Revolution : Increased production of fisheries based on scientific management.

Callus : Unorganised mass of cells produced after growth of explant.

Concentrate : Mineral rich food components e.g., Cereal grains, bran, maize and oil cake etc.

Culture Fishery : Rearing of fishes in artificial fresh water bodies such as pond, lake reservoir using scientific methods of feeding, breeding etc. as to enhance the output production of fish is called water agriculture or farming.

Colchicine : An alkaloid used to prevent the formation of spindle apparatus during mitosis. It helps in production of polyploids.

Domestication : Process of bringing a species under human management.

Emasculation : Removal of anthers from a bisexual flower which may be considered as female in a cross.

Exotic Breeds : Good quality breeds introduced in an area from an outside country.

Explant : A part of plant excised from its original location and used for tissue culture.

Fry : Young ones of fishes about 3-14 days old.

Genetic Engineering : The technique involved in altering the characters of an organism by inserting genes from another organism into its DNA.

Germplasm Collection : The entire collection (of plants/ seeds) having all the diverse alleles for all the genes in a given crop.

Green Revolution : Increased production of food due to scientific management.

Horticulture : It is a branch of agriculture and deals with act of growing vegetables, fruits and ornamental plants.

Hybridization : Method of producing new individuals by crossing parents with different genetic constitution. It brings about variation.

Heterosis or Hybrid Vigour : The superiority of F1 hybrids over either of the parents in terms of yield, growth or any other function.

Inbreeding : Breeding by self pollination or selfing or between the members of same population, variety or species.

Inbreeding Depression : Continued close inbreeding decreases the fertility and productivity.

Livestock : Domesticated animals like cattle, sheep, goat, camel, horse and pigs etc.

Line/ Breed : Group of individuals related by descent.

Out Breeding : Crosses between different breeds.

Plant Breeding : An applied branch of Botany which deals with improvement of economically important plants.

Pisciculture : Rearing of fishes to increase meat yield.

Poultry : Rearing of birds to increase meat yield and egg.

Pureline : It is a progeny of single self fertilized homozygous individuals.

Quarantine : All biological introduction are carefully examined for the presence of weeds, pests and pathogens. It reduces the risk of entry of a pathogen in country.

Super Ovulation : Stimulation of good female animal to release more eggs.

Swarms : Group of bees.

Swarming : Leaving off old queen with some workers and drones to start a new colony at a new place.

Sac Fry : Newly hatched larva with yolk sac.

Trait : Morphological, anatomical, biochemical or behavioural features of an organism.

ABBREVIATIONS

Bt : *Bacillus thuringiensis*

ET : Embryo Transfer

IARI	:	Indian Agricultural Research Institute
ICAR	:	Indian Council for Agricultural Research
IVRI	:	Veterinary Research Institute of India
MOET	:	Multiple Ovulation Embryo Transfer
NDDB	:	National Dairy Development Board
NDRI	:	National Dairy Research Institute
SCP	:	Single Cell Protein
STP	:	Sewage Treatment Plant

QUESTIONS

VAS (1 MARK)

1. Name the two factors on which the yield of milk depends.
2. How is inbreeding depression got rid off?
3. Name the scientist who developed semi-dwarf varieties of wheat in Mexico.
4. Where was IR-8 developed?
5. Write the scientific name of a microorganism which produces high quantity of protein.
6. Give an example of a somatic hybrid produced.
7. Give the reasons for the following statements :
 - (i) Genetic variations are heritable.
 - (ii) Pure line represent the progeny of homozygous plant.
 - (iii) Selection only helps to isolate the good genes but fails to make the genes better.
 - (iv) Most of the mutations are not expressed.
 - (v) Cattle feed must contain additive feeds.
 - (vi) Fish meat is considered next to the mother's milk as baby food.
8. How do roughage and concentrate differ from each other?
9. Differentiate between layers and broilers.
10. Give the nutritive importance of honey.
11. Write any three objectives of plant breeding.
12. Name four plants which are pollinated by bees.

13. Write two qualities of *Saccharum officinarum* (sugarcane) grown in South India.
14. Name two fungal diseases of plants.
15. Name the compounds present in the crop products that have adverse effects on animal growth.
16. What do you mean by bio-fortification?
- *17. Why prawn fisheries are named so? Whereas prawn is an arthropod.
- *18. Why X-rays and gamma rays etc. induce mutations?

SA – II (2 MARKS)

19. Give two examples of each-fresh water and marine water fishes.
20. A new breed of sheep was developed in Punjab by crossing two different breeds of sheep. Name the two breeds which were crossed and the new breed developed.
21. Differentiate between Pisciculture and Aquaculture.
22. Study the table given below and fill in the blanks marked A, B, C and D.

S.No.	Crop	Variety	Resistant to disease
1.	Wheat	Himgiri	A
2.	Brassica	B	White rust
3.	Cauliflower	Pusa Shubhra	C
4.	Chilli	Pusa Snowball K-1 Pusa sadabahar	D

22. Study the table given below and fill in the blanks marked A, B, C and D.

S.No.	Crop	Variety	Resistant to disease
1.	Brassica (Rape seed Mustard)	Pusa Gaurav	A
2.	Flat bean	Pusa Sem. 2 Pusa Sem. 3	B & C
3.	D	Pusa Sawani Pusa A-4	Shoot and fruit borer

24. What is emasculation? Explain its importance in hybridisation.
25. What is Single Cell Protein? What is the significance of such a protein?
26. Which part of the plant is best suited for making virus free plants and why?
27. Mention the factors responsible for the success of Green Revolution.
28. What are the disadvantages of conventional hybridisation in plants?
29. What are the objectives of breeding for improving nutritional quality.
30. What is meant by germ plasm collection? Why is it necessary?

SA - I (3 MARKS)

31. What is mutation? What is the significance of mutation in biological world? Name any two agents that induce mutation.
32. What is inbreeding and interspecific hybridisation in animals. Give an example of each.
33. Name the products obtained from apiculture. What are their uses?
34. Why was hybridisation carried out between the species of sugarcane grown in North India and that grown in South India?
35. Name three traits/characters which have been incorporated into crop plants by plant breeders to increase crop yield and quality.
36. Give sequential steps of breeding programme.
37. What is meant by biofortification? Give examples.

LA - I (5 MARKS)

38. What is somatic hybridisation? Explain the various steps involved in the process. Mention any two uses of somatic hybridisation.
39.
 - (i) What is a protoplast?
 - (ii) Name the two enzymes used in producing protoplasts.
 - (iii) Describe the steps in producing somatic hybrids from protoplasts.
40. Enumerate the points that have to be considered for successful bee-keeping.
41. Describe the process of MOET (Multiple Ovulation Embryo Transfer). Also mention its use.
42. Describe five examples of crop plants that have been fortified.

ANSWERS

VAS (1 MARK)

1.
 - (i) The quality of the breed
 - (ii) The type of feed.
2. By mating the selected animals from one population with unrelated superior animals of the same breed.
3. Norman. E. Borlaug
4. At the International Rice Research Institute (IRRI). Philippines.
5. *Spirulina*

6. Pomato (a hybrid between potato and tomato)
7.
 - (i) Heritable variation is due to genotype and is transmitted from one generation to other. Such variations are useful in selection.
 - (ii) Self pollinated crops gradually becomes homozygous. Best homozygous individuals can be isolated from such crops. By selection, pure lines are produced.
 - (iii) Selection cannot bring out anything which is not already in genes.
 - (iv) Recessive genes are more prone to mutations hence they may not be expressed.
 - (v) Additive feed contain antibiotics, minerals and hormones which may not only increase the growth of animals and yield of milk but also protect them from diseases.
 - (vi) The fish meat has more proteins than the meat of other animals and is comparatively more easily digestible. It also contains less fats but large amounts of Vitamin A and D and iodine.
8. Roughage contains fibres but less nutrients e.g., fodder while the concentrate is rich in nutrients e.g., cereal grains.
9. The layers are the egg laying birds, while the broilers are meat-yielding birds.
10. Honey contains sugars like dextrose, maltose, levulose, enzymes, minerals, vitamins and water.
11. (i) Higher yield, (ii) Better quality, (iii) Disease, insect and pest resistance.
12. Sunflower, Brassica, Apple and Pear etc.
13. Thicker stem and higher sugar content.
14. Brown rust of wheat, red rot of sugarcane and late blight of potato.
15. Glucosinolates in rap seed and mustered, Neurotoxin in Khesari Dal.
16. Breeding crop with more than one normal composition of nutrients.
- *17. As prawns are cultured like fish and can be sold like fish to grow economy of the country.
- *18. X-rays and gamma rays produce ionizing effect in DNA molecules. They distort or break DNA duplex and disturb the replication.

SA - II (2 MARKS)

19. *Fresh Water Fishes* : Rohu, Catla, Carp etc.
 Marine Water Fish : Hilsa, Sardine, Pomfret etc.
20. By crossing Bikaneri ewes and Marino rams the new breed Hissardale was developed.
21. *Pisciculture* : Rearing of fishes to increase meat yield.
Aquaculture : Production of useful aquatic plants.
22. A : Leaf and stripe rust, hill bunt.

- B : *Pusa swarnim* (Karan rai)
- C : Black rot and curl blight
- D : Chilli mosaic virus, Tobacco mosaic virus and leaf curl.
23. A : Aphids
- B&C : Jassids, aphids and fruit borer.
- D : Okra (Bhindi)
24. *Emasculation* : The process of removal of anthers before they mature from a bisexual flower. That is to be used as female parent. It is done to prevent self pollination in these plants.
25. *SCP* : The biomass obtained from micro-organisms, where the cells are treated/processed in various ways and used as food or feed.
- Significance* : It provides a protein rich diet for human beings.
 - SCPs based on industrial effluents helps to reduce environmental pollution.
26. Apical meristem
- Even in a plant infected by virus, the apical meristems are free of virus, it can be easily removed and grow *in vitro* to obtain virus free plants.
27. (i) Use of hybrid varieties
- (ii) Use of fertilizers
- (iii) Increased irrigation facilities
- (iv) Availability of cultivable land.
28. Conventional breeding can use only those genes that are present in such species that can be hybridised.
- Changes occur in all those traits for which the parents used for hybridisation differ from each other.
29. To increase :
- (i) Protein content and quality
 - (ii) Oil/fat content and quality
 - (iii) Vitamin content
 - (iv) Mineral nutrient content.
30. The sum total of all the alleles of the genes present in an individual organism and its related species is called germplasm collection.
- Genetic variability is the root of any breeding programme.

- Collection of germ plasm is necessary for exploitation of natural genes available in the populations.

SA – 1 (3 MARKS)

31. *Mutation* : Sudden heritable change in the character of an organism, due to change in the sequence of bases in the gene(s).
- It result in a new character or trait; not found in the parental type.
 - Mutations can also be induced by using mutagens.
 - Such plant materials are used as such or used for breeding new varieties.
 - Mutagens—gamma radiations, x-rays etc.
32. *Inbreeding* : Mating/crossing of closely related individuals of the same breed. It increases homozygosity and results in inbreeding depression.
- Interspecific Hybridisation* : Crossing/mating of individuals of two different species e.g., mule produced by crossing female horse and male donkey or hinny produced by crossing male horse and female donkey.
33. Honey and Beewax
- Honey* : is a food substance and it is also medicinally important.
 - Beewax* : is used in manufacturing of cosmetics and polishes.
34. Hybridisation was carried out between sugar canes of North India (*Saccharum barberi*) and South India (*Saccharum officinarum*) for successfully combining the high yield, high sugar content and thicker stems of *S. officinarum* into that of North Indian sugarcane *S. barberi* as *S. officinarum* cannot grow in North India.
35. (i) Increased tolerance to environment stresses (salinity, drought and extreme temperature conditions)
- (ii) Resistance to pathogens (viruses, fungi and bacteria etc.)
- (iii) Increase tolerance to insect pests.
36. (i) Screening suitable germplasm having variability (germplasm collection)
- (ii) Evaluation and selection of parents
- (iii) Cross breeding or hybridisation
- (iv) Selection and testing of superior recombinants
- (v) Testing release and commercialisation of new cultivars.
37. Plant breeding programme designed to increase vitamins, minerals, higher proteins and healthier fat content in crops. e.g., Maize hybrids have twice the amount of amino acid Lysine and Tryptophan. Wheat variety Atlas-66 has high protein content.

LA (5 MARKS)

38. *Somatic Hybridisation* : The process of fusing protoplasts of somatic cells derived from different varieties or species of plants, to produce a hybrid.

Steps :

- (i) Removal of cells wall of fusing cells by digestion with a combination of pectinase and cellulase to form protoplasts.
- (ii) Fusion between protoplasts of selected parents is induced by the use of polyethylene glycol.
- (iii) The resulted product is cultured on a suitable medium to regenerate cell walls.
- (iv) The cells obtained begin to divide to produce plantlets called somatic hybrids.

Uses :

- (i) Somaclonal variations can be created.
 - (ii) Lines or varieties (species) of plants which cannot be sexually hybridised. Can be hybridised and allopolyploids can be raised by this method.
39. (i) The plant cells lacking cell wall are called protoplasts.
(ii) Enzymes pectinase and cellulase.
(iii) For steps Ref. Ans. to Qs. 38.
40. Knowledge of the nature and habits of bees.
 Selection of suitable location of keeping beehives.
 Catching and hiving of swarms.
 Management of beehives at different seasons.
 Handling and collection of honey and beeswax.
41. MOET is a method to improve the herd.

Steps :

- (i) A cow is administered hormones like FSH to induce follicular maturation and super ovulation *i.e.*, production of 6-8 ova in one cycle.
- (ii) Mating cow with selected bull or by artificial insemination.
- (iii) Fertilised eggs at 8-32 celled stage are recovered.
- (iv) The eggs are transferred to surrogate mothers.

Use : The size of herd can be increased in a short time *i.e.*, High milk yielding breeds of females and high quality meat yielding bull can be obtained in a large no. in short time.

42. Fortified Crop Plants

<i>S.No.</i>	<i>Nutrient Enriched</i>	<i>Crop/Plants</i>
1.	Lysine and tryptophan	Maize
2.	Vitamin C	Tomato, mustard
3.	Iron and Calcium Minerals	Spinach
4.	Vitamin A	Carrots, pumpkin
5.	Protein	Wheat, garden pea and broad beans

CHAPTER 10

MICROBES IN HUMAN WELFARE

POINTS TO REMEMBER

Activated Sludge Process : Aerobic sewage treatment process using aerobic micro-organisms present in sewage sludge to break down organic matter in sewage.

Antibiotics : The chemicals derived from micro-organisms and used against harmful pathogens. They kill or retard the growth of pathogens. *e.g.*, Penicillin.

Anaerobic Sludge Digesters : Large tanks where remaining part of flocs is pumped back for digestion of some bacteria and fungi by anaerobic bacteria producing biogas.

Biofertilisers : Microorganisms which produce fertilisers and enrich the soil *e.g.*, Bacteria, cyanobacteria and fungi.

Biogas : Useful end product of biological treatment of sewage. It consists of mixture of methane, H₂S and CO₂.

Bioactive Molecules : Molecules produced for commercial use from microbes and used for various purposes *e.g.*, *Trichoderma polysporum* (fungus) is used to obtain immunosuppressive agent cyclosporin A.

Biochemical Oxygen Demand : Total amount of oxygen consumed by bacteria for oxidation of organic matter present in one litre of water.

Baculovirus : Pathogens that attack insects and other arthropods. They are used to kill harmful pests and arthropods *e.g.*, Nucleopolyhedrovirus.

Biocontrol Agents : Use of biological methods for controlling plant diseases and pests

Effluent : The product of primary treatment of sewage which is passed into large aeration tanks for secondary treatment.

Fermentation : The process by which microorganisms turn organic materials such as glucose into products like alcohol.

Fermenters : A very large vessel used in industry where microbes are grown on an industrial scale.

Flocs : During secondary treatment of effluent, excessive growth of aerobic bacteria and fungi form a mass of mesh like structure called flocs.

Fermented beverages : The beverage chemicals produced by the process of fermentation *e.g.*, Wine, beer and whisky etc.

Immuno Suppressive Agent : Chemical substances which suppress the immunity against organ transplant.

Insecticide : The chemical by which harmful insects (pests) are killed.

Lactic Acid Bacteria : Bacteria growing in milk and convert it into curd *e.g.*, Lactobacillus.

Mycorrhiza : Symbiotic association of fungi with roots of higher plants to absorb water and minerals from the soil.

Methanogens : Bacteria which grow anaerobically on cellulosic material and produce methane along with CO₂ and hydrogen.

Primary Sludge : The raw form of sewage which comes for primary treatment.

Primary Treatment : The treatment steps involve removal of small and large particles through filtration and sedimentation. The supernatant forms the effluent.

Organic Farming : Technique of farming, in which biofertilisers are used to enrich the soil.

Sewage : The organic waste matter containing water. It includes municipal waste water and large amount of organic matter and microbes which may be pathogenic.

Secondary (Biological) Treatment : Treatment on the primary effluent in a large aeration tank with the help of aerobic and anaerobic microbes to reduce BOD. Finally biogas is isolated and effluent is released into natural water body.

Toddy : A traditional alcohol drink derived from palm tree by fermentation and used in Southern India.

ABBREVIATIONS

BOD	:	Biochemical Oxygen Demand
DO	:	Dissolved Oxygen
GAP	:	Ganga Action Plan
KVIC	:	Khadi and Village Industries Commission
LAB	:	Lactic Acid Bacteria
TMV	:	Tobacco Mosaic Virus
YAP	:	Yamuna Action Plan

QUESTIONS

VSA (1 MARK)

1. What determines the nature of alcoholic drinks?
2. State one difference between Primary and Secondary treatment.
3. Give the significance of biofertilizers.

4. Give reasons for the following statements :
- (i) BOD and DO have inverse relationships,
 - (ii) Bt cotton is resistant to attack of insect pests.
 - (iii) Secondary treatment of waste water in STP is called biological treatment.
 - (iv) *Saccharomyces cerevisiae* is commonly called Baker's yeast.
 - (v) Biocontrol helps in ecosystem stabilization.
5. How can a small amount of curd added to fresh milk convert it into curd?
6. The Swiss cheese contains large holes in it. How these large holes are made in it.
7. Name the scientist who discovered the first antibiotic. Also mention the name of antibiotic.
8. How do statins reduce the blood cholesterol level?
9. Name any two gases produced during secondary treatment of sewage.
10. What are Prion's?
11. Write the components of biogas.
12. The sap of which plant is used in making 'Toddy'? Also mention the process involved in it.
13. Which microb is used for commercial production of ethanol?
14. Cyanobacteria are used as biofertilisers in certain crop fields. Name such one crop. Also mention the names of two other micro-organisms which perform the same function.
- *15. The generation time of microbacterium cells present in activated sludge is 40 minutes. If cells are allowed to grow for 8 hours, how many generations would have taken place?
- *16. An antibiotic called 'Wonder Drug' was used to treat the wounded soldiers of America during II World War. Name the drug and the scientist who discovered it.
- *17. You have observed that bottles fruit juices bought from the market are clearer as compared to those made at home. Give reason.
- *18. Alexander Fleming discovered 'Penicillin', but its full potential as an effective antibiotic was established by other two scientists. Name them.

SA II (2 MARKS)

19. Name any two varieties of cheese and mention the names of the microbes used.
20. Name any four industrial products that employ microbes in their production.
21. Draw a labelled diagram of a flagellated rod shaped bacteria.
22. Name any four alcoholic beverages.

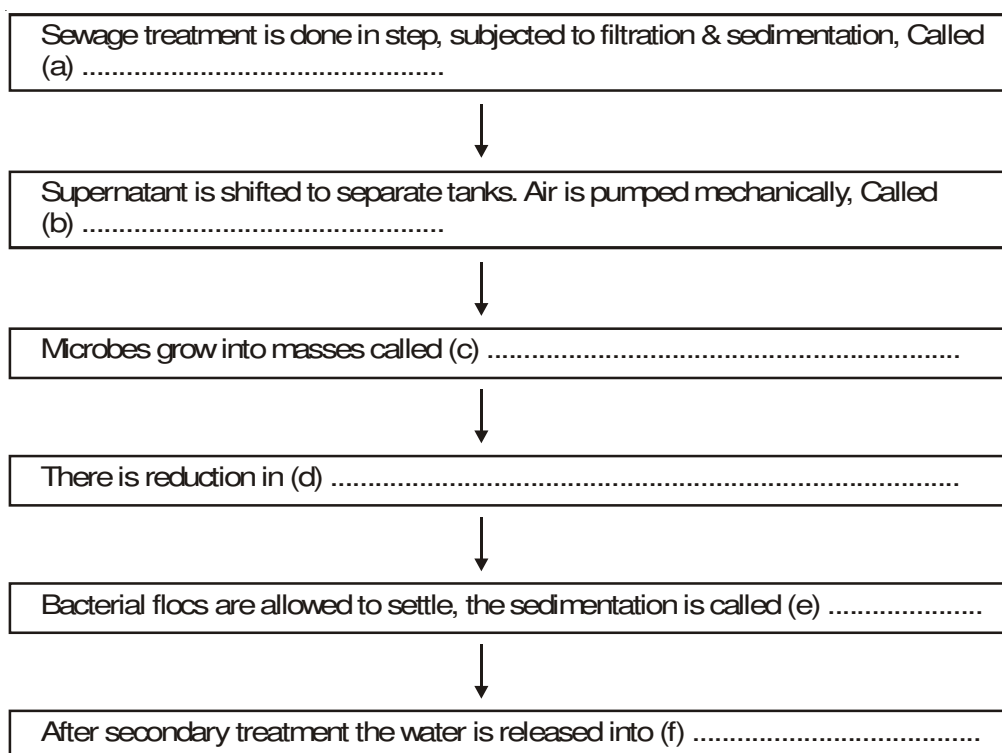
23. Name two alcoholic drinks produced in each of the following ways : (i) with distillation and (ii) without distillation.
24. Mention any four diseases that can be treated by antibiotics.
25. What are methanogens? Give an example also name four places where they are found.
26. How do mycorrhizae function as biofertilisers?
27. Write about the proposals made in Ganga Action Plan and Yamuna Action Plan. Which ministry of Govt. of India has initiated these plans?
28. Discuss the role of 'flocs' in sewage treatment.
- *29. "For insecticidal applications viruses are considered as excellent candidates". Comment upon this statement.
- *30. What is green manure? Name any two crop plants which are used as green manure.
- *31. Mention two other functions of LAB that are useful to man, (other than the conversion of milk into curd).

SA - I (3 MARKS)

32. Name any three organic acids and the bacteria that produce them.
33. What are statins? Where are they produced from? How are they useful to man?
34. Draw a labelled diagram of typical Biogas Plant. Write two uses of biogas.
- *35. Fill in the blanks spaces a, b, c, d, e and f given in the following table :

S. No.	Name of Organisms	Commercial Product	Application
1.	<i>Penicillium notatum</i>	Penicillin	a
2.	b	Lactic Acid	Making curd
3.	<i>Streptococcus</i>	clot buster enzyme	c
4.	<i>Trichoderma polysporum</i>	d	immuno suppressive agent
5.	<i>Saccharomyces cerevisiae</i>	e	f.

- *36. What is measure in BOD test? BOD level of three samples of water labelled as A, B and C are 30 mg/l, 10mg/l and 500 mg/l respectively. Which sample of water is most polluted?
- *37. Given below is the flow chart of sewage treatment. Fill in the blank spaces marked a to f in the chart (*given on next page*) :



LA (5 MARKS)

38. Before disposal, sewage is treated in sewage treatment plant. Explain the steps taken for making it less polluting.
39. What are bio-fertilisers? Name the categories of organisms used as biofertilisers with an example of each. How do they function in organic farming?

ANSWERS

VSA (1 MARK)

1. The nature of alcoholic drinks is determined by the type of raw material used and type of processing.
2. Primary treatment involves the removal of large sized solids by physical methods while secondary treatment involves decomposition of organic wastes by microbial action.
3. Biofertilizers increase the soil fertility and reduce the use of chemical fertilizers and chances of environmental pollution.
4. (i) Presence of high amount of organic wastes in the water increase the oxygen required by the microbes to decompose the organic wastes which increases BOD. The microbes derive this oxygen from the water which decrease DO in the water.
(ii) Because this variety of cotton has a toxin-producing gene (Bt-gene) transferred to it from the bacterium *Bacillus thuringiensis* by genetic engineering.

- (iii) In this treatment organic wastes of sewage water are decomposed by certain microorganisms in presence of oxygen.
 - (iv) It is used as a leavening agent and to flavour various food products.
 - (v) Biocontrol agents do not eliminate the pests completely but keep their number within manageable levels. This increases the biodiversity and chances of stability of the ecosystem.
5. Millions of lactic acid bacteria are found in small amount of curd which multiply and convert the milk into curd by the lactic acid produced.
 6. In Swiss cheese the large holes are produced by the large amount of carbondioxide formed by *Propionibacterium Sharmanii*.
 7. The first antibiotic discovered was penicillin, by Alexander Fleming from fungi *Penicillium notatum*.
 8. Statins act by competitively inhibiting the enzymes responsible for synthesis of cholesterol.
 9. The gases produced are hydrogen sulphide and carbondioxide.
 10. Prions are proteinacious infectious agents.
 11. Methane, hydrogen, hydrogen sulphide and carbondioxide
 12. Palm tree
 by fermentation
 13. Yeast (*Saccharomyces cerevisiae*)
 14. Paddy (rice crop)
 Nostoc, Anabaena, Oscillatoria
- *15. Number of generations = $\frac{8 \times 60 \text{ minutes}}{40 \text{ minutes}} = 12$
- *16. Penicillin, Alexander Fleming
- *17. Bottled juices are clarified by the use of pectinase and proteases.
- *18. Ernest chain and Howard Florey.

SA - II (2 MARKS)

19. Swiss cheese – *Propionibacterium*
Roqueford cheese – A specific fungus
20. (i) Enzymes (ii) Antibiotics
(iii) Organic acids (iv) Fermented beverages
(v) Bioactive molecules

21. Ref. Figure 10.1 (c) Page 180, NCERT XII, Biology
22. (i) Wine (ii) Beer
(iii) Whisky (iv) Brandy
(v) Rum (any Four)
23. With distillation – Brandy, Whisky, Rum.
Without distillation – Wine, Beer
24. (i) Diphtheria (ii) Whooping cough
(iii) Leprosy (iv) Plague
25. The bacteria which produce large quantity of methane during the decomposition of organic matter e.g., *Methanobacterium*.
 They are found in (i) marshy places, (ii) Flooded rice fields, (iii) rumen of cattle, (iv) The anaerobic sludge.
26. The fungus absorbs phosphorus and passes it to the plant.
 Increase the tolerance to salinity and drought.
 Give resistance to plant to root-borne pathogens.
 Induce an overall increase in the plant growth and development.
27. The Ganga Action Plan and Yamuna Action Plan were proposed by the Ministry of Environment and Forests.
 It was proposed to build a large no. of sewage treatment plants. So that only treated sewage may be discharged into the rivers to save these major rivers from pollution.
28. Floccs are the masses of bacteria associated with fungal filaments to form mesh like structure.
 They 'consume' major part of organic matter present in the sewage.
- *29. Viruses like *Nucleopolyhedrovirus* are pathogens that attack insects and other authropods. *Baculoviruses* have been shown species-specific, narrow spectrum insecticidal applications.
- *30. 'Green manure' is a quick growing crop which is cultivated and ploughed under the soil to provide organic matter and additional nitrogen.
 Lens esculanta (lentil)
 Vigna sinensis (cow pea)
- *31. (i) LAB in human intestine synthesize vitamin B₁₂
(ii) LAB in human stomach checks the growth of harmful microbes.

SA - I (3 MARKS)

32. (i) Acetic acid *Acetobacter aceti*
(ii) Butyric acid *Clostridium butylicum*
(iii) Lactic acid *Lactobacillus delbrueckii*
33. Statins are cholesterol reducing agents.
 They are produced by *Monascus purpureus*
 They act by competitively inhibiting the enzymes of cholesterol synthesis and are used as blood cholesterol lowering agents.
34. Ref Figure 10.8, page 186, NCERT XII, Biology.
- *35. (a) To kill disease causing bacteria.
(b) *Lactobacillus*
(c) Remove clots from blood vessels
(d) Cyclosporine-A
(e) Ethanol
(f) Wine, whisky
- *36. (a) BOD test measures the rate of uptake of oxygen by microorganisms in a sample of water.
(b) Greater the BOD of water, more is the pollution.
(c) Sample 'C' is most polluted because it has highest BOD level among the three samples of water.
- *37. (a) Primary treatment (b) Aeration
(c) Floccs (d) BOD/Biochemical Oxygen Demand
(e) Activated sludge (f) Water bodies like river, stream.

LA (5 MARKS)

38. *Primary Treatment* : (Physical Process of removal of small and large particles through (i) filtration (ii) sedimentation

Then it is allowed to go into primary settling tank where suspended materials settle down to form primary sludge.

- Secondary Treatment* : It is biological process that employs the heterotrophic bacteria naturally present in the sewage.
- Primary sludge is passed into aeration tanks for rapid growth of aerobic bacteria in to floccs, which reduce the BOD.

- A small part is pumped back into aeration tank as inoculum.
 - Remaining part is pumped into anaerobic sludge digesters.
 - The effluent from this is passed in the water body.
39. Biofertilisers are those organisms which enrich the soil fertility.
- Bacteriaa – *e.g.*, *Rhizobium*, *Azotobacter*
 - Cyanobacteria – *e.g.* *Nostoc*, *Anabaena*
 - Mycorrhizae* (fungi) – *e.g.*, *Glomus*

Functions

- Bacteria and Cyanobacteria fix atmospheric nitrogen and increase the nitrogen-content of soil.
- The fungi decompose the organic matter of the soil and make the nutrients available to the roots.

CHAPTER 11

BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

POINTS TO REMEMBER

Amplification of gene : Formation of many copies of a DNA segment of PCR.

Annealing : The process of heating and slowly cooling of double stranded DNA to allow the formation of hybrid DNA molecules.

Bacteriophage : A virus that infects bacteria.

Biolistics (Gene gun) : The technique of bombarding microprojectiles *i.e.*, gold/tungsten particle coated with foreign gene with great velocity into the target cells.

Biomass : The cell mass produced by a population of living organisms.

Bioreactor : A large vessel with stirring arrangement in which organic raw materials are biologically converted into specific products under optimal conditions.

Biotechnology : It deals with techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans.

The definition given by EFB : The integration of natural science and organisms, cells, parts thereof and molecular analogues for products and services.

Biotransformation : The use of cultured cells to convert substrates into desired organic compounds by the virtue of an endogenous enzyme which catalyses the reaction.

Capsid : External protein coat of a virus particle.

cDNA Clone : A double stranded DNA complement of mRNA synthesised *in vitro* by using reverse transcriptase and DNA polymerase.

Cell Culture : Cell culture of growing cells *in vitro* in liquid medium.

Cell suspension : Cells in liquid medium often used to describe suspension culture of a single cell and cell aggregates.

Clone : A collection of genetically identical cells or organisms derived from a common ancestor where all members have similar genetic composition.

Cloning : It is the process of producing many identical copies of organisms and cells.

Cloning Site : A location on a cloning vector into which DNA can be inserted.

Cloning Vectors : A small, self-replicating DNA molecule into which foreign DNA is inserted in the process of cloning genes or other DNA sequence.

Complementary DNA : A DNA strand formed from mRNA by using the enzyme reverse transcriptase.

Denaturation : Separation of double stranded DNA molecule into single strands.

Disarmed Plasmid : A plasmid from which some portion has been detected.

DNA Amplification : Multiplication of a piece of a DNA in a test tube into many thousand or million of copies by using polymerase chain reaction.

DNA Polymerase : An enzyme that catalyses the phosphodiester bond in the formation of DNA.

Downstream Processing : Separation and purification of product(s) from a fermentation process.

Endonuclease : An enzyme that catalyses the cleavage of DNA at internal position, cutting DNA at specific sites.

Exonuclease : An enzyme that removes nucleotides from the ends of the DNA.

Fermentation : The process by which microorganisms turn raw materials such as glucose into products such as alcohol.

Genetic Engineering : Techniques to alter the chemistry of genetic material to introduce these into host organisms and thus change the phenotype of the host organisms.

Gel Electrophoresis : It is a technique to isolate VNTR DNA fragments with the help of gel agarose, nylon membrane and probe sequence.

Insert DNA : A DNA molecule incorporated into a cloning vector.

Insertional Inactivation : The presence of recombinant can be detected by a procedure that is based on the principle that cloned DNA fragments disrupt the coding sequence of a gene.

In Vitro : Any process carried out in sterile cultures or measurement of biological processes outside the intact organism such as enzyme reaction.

Ligase : An enzyme used by a genetic engineer to join the cut ends of the double stranded DNA.

Micro Injection : A technique of injecting DNA or RNA into the nucleus of protoplast of cell with the help of a micropipette.

Origin of Replication (Ori) : It is a sequence from which replication starts and any piece of DNA, when linked to this sequence can be made to replicate within the host cell.

Palindromic Sequence : Complementary DNA sequences that are the same when each strand is read in the same direction (5' →3'). These sequences act as recognition sites for Type II restriction endonuclease.

Plasmid : Extrachromosomal, self replicating circular double stranded DNA containing some non-essential genes.

Polymerase Chain Reaction (PCR) : The action of the enzyme polymerase to produce many copies of a polynucleotide sequence of DNA at high temperature.

Recombinant DNA (rDNA) : The hybrid DNA produced by joining pieces of DNA at specific points.

Restriction Enzymes : The enzyme that cut out a piece of DNA at a specific location (recognition site).

Recognition Sequence : Recognition enzyme cut DNA molecule at a particular point by recognizing a specific sequence of six base pairs. This specific base sequence is termed as recognition sequence for the enzyme.

Restriction Site : The sequence of nucleotide pairs of double stranded DNA that is recognised by a type II restriction endonuclease.

Recombinant Protein : The protein encoding gene which is expressed in a heterologous host.

Selectable Marker : It is a gene which helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformants.

Stem Cell : A precursor cell that undergoes division and gives rise to different lineages of differentiated cells.

Sticky Ends : Single stranded complementary nucleotides on the ends of double stranded DNA molecule.

Taq Polymerase : A heat stable DNA polymerase isolated from a thermophilic bacterium *Thermus aquaticus* and used in PCR.

Ti Plasmid : An extrachromosomal, double stranded and self replicating DNA molecule found in *Agrobacterium tumefaciens* that causes crown disease in plants.

Transformation : Transformation is the phenomenon by which the DNA isolated from one type of cell, when introduced into another type, is able to bestow some of the properties of the former to the later e.g., Antibiotic resistance gene in *E. coli*.

ABBREVIATIONS

EFB	:	European Federation of Biotechnology
cDNA	:	Complementary DNA
rDNA	:	Recombinant DNA
<i>E.coli</i>	:	<i>Escherchia coli</i>
Taq	:	<i>Thermus aquaticus</i>
Ti plasmid	:	Tumor inducing plasmid

QUESTIONS

VSA (1 MARK)

1. Which is responsible for initiating DNA replication. Name it.
2. At what stage of meiosis, a recombinant DNA is made?
3. State the function of plasmid in recombinant DNA technology.

4. Which enzyme is used to release DNA from a bacterium?
5. Why are restriction enzymes known as molecular scissors?
6. Identify the recognition sites in the given sequences at which *E. coli* will be cut and make sticky ends.

5'–GAATTC–3'

3'–CTTAAG–5'

7. Name the enzyme which is used in PCR.
- *8. A linear DNA fragment and a plasmid has three restriction sites for *EcoRI*. If both are completely digested with *EcoRI*, how many fragments will be produced from linear DNA and plasmid respectively.
- *9. Which technique is used to separate DNA fragments on the basis of charge/mass ratio?
- *10. Name the bacterium of which tumor inducing plasmid has now been modified into non-pathogenic form and is used as a cloning vector.

SA – II (2 MARKS)

11. Name two main steps which are collectively referred to as down stream processing. Mention why this process is significant.
12. What were two main discoveries that led to the birth of genetic engineering?
13. Which out of these is not a matching pair and why?
 - (a) Plasmid : autonomously replicating circular extra chromosomal DNA
 - (b) Restriction enzyme : molecular scissor
 - (c) Ligases : enzyme used to break foreign DNA
 - (d) Cloning : the process of producing many identical copies of organisms.
14. How does Plasmid DNA differ from chromosomal DNA.
15. A bacterial cell is shown in the given figure. Label the part 'A' and 'B'. Also, mention the use of the part 'A' in rDNA technology.



16. Mention two classes of restriction enzymes. Suggest their respective role.
17. Define cloning. Give a reason why animal cloning is difficult than plant cloning.

18. How RNA and proteins can be removed during isolation of DNA?
- *19. In the given process of separation and isolation of DNA fragments, some of the steps are missing. Complete these missing steps.

A. Restriction Digestion of DNA fragments

B.

C. Staining with Ethidium bromide.

D. Visualization in U.V. light.

E.

F. Purification of DNA fragments.

20. Name the method and type of cells are transformed by
- directly transferring to the nucleus.
 - bombarded with high velocity microparticles coated with DNA.

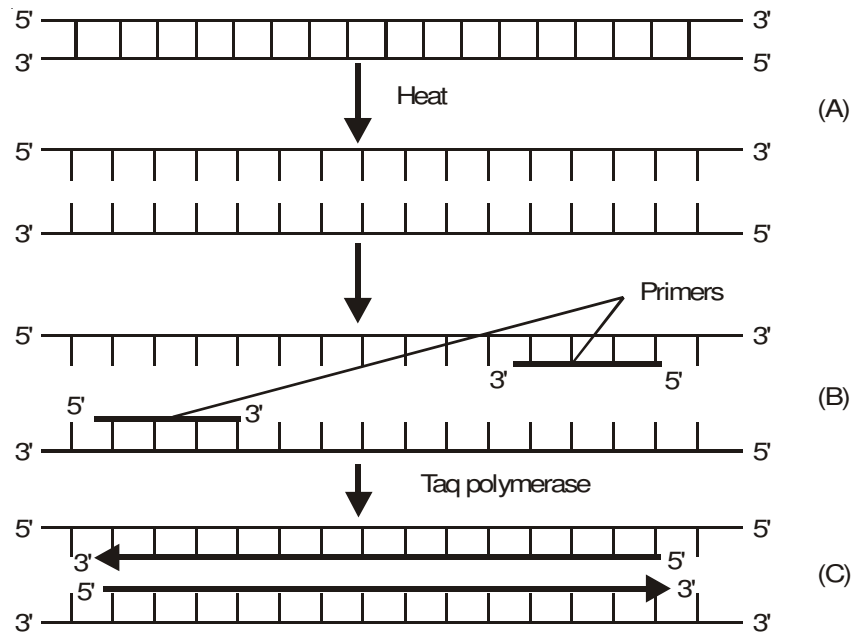
SA - I (3 MARKS)

21. Mention three basic steps in genetically modifying an organism.
22. What difficulty do you find in passing DNA into the host cells. How is it forced into the cell. Give any two methods.
23. How will you obtain the purified DNA fragments from a cell for the process of genetic engineering?
24. Make a diagrammatic representation of recombinant DNA technology showing a restriction enzyme, the substrate, DNA on which the restriction enzyme acts, the site at which it cut DNA fragment and the product produces.
25. You are provided a bacterial cell, plant cell and animal cell. How would you make these cells competent host cell for the transformation with recombinant DNA.
26. In recombinant DNA technology vectors are used to transfer a gene of interest in the host cells. Suggest any three features of vectors that are most suitable for this purpose.
- *27. In an experiment, it had been observed that in a bacterial culture, some of the colonies is produced blue colour in the presence of chromogenic substrate and some died not due to presence of an insert (rDNA) in the coding sequence of β -galactosidase.
- What was the purpose of the experiment?
 - Explain the mechanism involved.

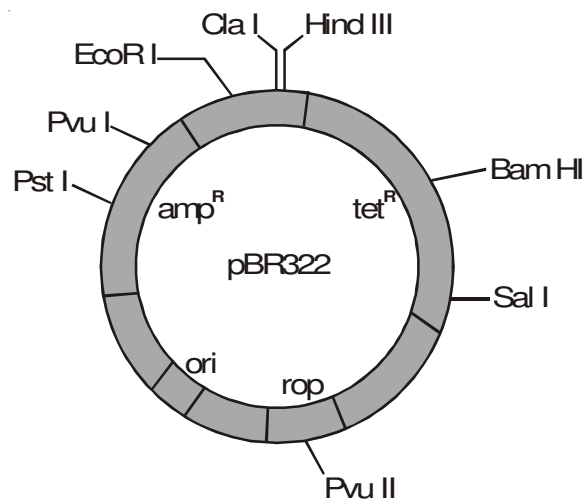
- *28. Why is “*Agrobacterium-mediated*” genetic engineering transformation” in plants considered as natural genetic engineering of plants?
- *29. Observe the given sequence of nitrogenous bases on a DNA fragment and answer the following questions.
- 5´-CAGAATTCTTA3´
- 3´-GTCTTAAGAAT5´
- (a) Name the restriction enzyme which recognized this DNA sequence.
- (b) Write the sequence after digestion.
- (c) Why are the ends generated after digestion called sticky ends?
- *30. A selectable marker is used in the selection of recombinants on the basis of their ability to produce colour in presence of chromogenic substrate.
- (a) Mention the name of mechanism involved.
- (b) Which enzyme is involved in production of colour.
- (c) How is it advantageous over using antibiotic resistant gene as a selectable marker.

LA (5 MARKS)

31. A biotechnologist wants to improve the quality of a crop through rDNA technology. Describe the steps involved in this technology.
32. The development of bioreactors is required to produce large quantities of products.
- (a) Give optimum growth conditions used in bioreactors.
- (b) Draw a well levelled diagram of simple stirred-tank bioreactor.
- (c) How ‘simple stirred-tank’ bioreactor differ from ‘sparged stirred-tank’ bioreactor.
- *33. In the given figure (on next page), one cycle of polymerase chain reaction is shown.
- (i) Name the steps A, B and C.
- (ii) Give the purpose of each these steps.
- (iii) State the contribution of *Thermus aquaticus* in this process.



34. Study the figure of vector pBR322 given below in which foreign DNA is ligated at the Bam HI site of tetracycline resistance gene.



Answer the following questions :

- Mention the function of *rop*.
- What will be the selectable marker for this recombinant plasmid and why?
- Explain the process of introduction of recombinant DNA into *E. coli* cells.

ANSWERS

VSA (1 MARK)

1. A specific DNA sequence called the origin of replication (ori) is responsible for initiating replication.
2. Pachytene stage of prophase I (meiosis)
3. Plasmid is used to transfer the foreign DNA fragment into host cell.
4. Lysozyme.
5. Restriction enzyme cut the DNA fragment at the specific sites.
6.
$$\begin{array}{c} \downarrow \\ 5' \text{G AATTC} 3' \\ 3' \text{CTTAA} \uparrow \text{G} 5' \end{array}$$
7. Taq polymerase
8. Number of fragments of linear DNA = 4
Number of fragments of plasmid = 3
9. Gel electrophoresis
10. *Agrobacterium tumefaciens*

SA II (2 MARKS)

11. Separation and Purification
 This process is essential because before reaching into market, the product has to be subjected for clinical trial and quality control.
12. (i) Discovery of restriction enzymes that cut DNA at specific sites.
(ii) Development of techniques in order to get new DNA fragments using cloning vectors like plasmids and phages.
13. (c) is not a matching pair, because ligases are those enzymes which are used to join foreign DNA to plasmid.
- 14.

<i>Plasmid DNA</i>	<i>Chlorosomal DNA</i>
(i) It is circular DNA	(i) It is linear DNA
(ii) Occurs in bacterial cells	(ii) Occurs in nucleus of eukaryotic cells
(iii) Used as Vector	(iii) It is not used as vector

15. A – Plasmid, B – Nucleoid

Plasmid is used as vector to transfer the gene of interest in the host cell.

16. Exonucleases and endonucleases
 Exonucleases remove nucleotides from the ends of the DNA.
 Endonucleases make cut at specific locations within the DNA.
17. Cloning is the process of producing many identical copies of organisms/genes.
 Plant cells are more totipotent than animal cells.
18. RNA can be removed by treatment with ribonuclease enzyme.
 DNA can be removed by treatment with protease enzyme.
19. B. Agrose gel eletrophoresis.
 E. Elution
20. (a) Method – Microinjection – animal cells.
(b) Method – Biolistics – plant cells.

SA I (3 MARKS)

21. (a) Identification of DNA.
(b) Introduction of the identified DNA in the host.
(c) Maintenance of introduced DNA in the host and transfer of the DNA.
22. DNA is hydrophilic molecule. So, it is difficult to pass through phospholipid membrane.
(i) Chemical method – Host cells be made competent to take up DNA.
(ii) Micro-injection method.
(iii) Biolistics or gene gun method.

Refer Page no. 200-201, Biology Book, NCERT

23. Cells are treated with appropriate enzymes to release DNA.
 RNA and proteins are removed by treatment with ribonuclease and protease enzymes, respectively.
 Purified DNA is precipitated by adding chilled ethanol.
24. Refer Figure 11.2 on Page 197. Biology NCERT.
25. Bacterial Cell Treating with a specific concentration of a divalent cations such as calcium ions (Ca^{2+})
Plant Cell Biolistic/gen gun
Animal Cell Micro-injection

26. (i) Smaller in size
(ii) Contain origin of replication (ori)
(iii) Incorporate a selectable marker or a gene
(iv) Must have at least one restriction site for restriction enzyme
27. (i) Selection of recombinant colonies from non-recombinants
(ii) A recombinant DNA is inserted with the coding sequence of enzyme β -galactosidase. It causes inactivation of enzyme.
28. *Agrobacterium tumefaciens* is pathogen in many dicot plants. It is able to deliver a piece of DNA (T-DNA) to transform normal plant cells into a tumor and directs these tumor cells to produce the chemicals required by the pathogen.
29. (a) *EcoRI*



- (c) These are named sticky ends, because they form hydrogen bonds with their complimentary cut counterparts.
30. (a) Insertional inactivation.
(b) β – galactosidase
(c) Selection of recombinants due to inactivation of antibiotics is a cumbersome procedure because it requires simultaneous plating on two plates having different antibiotics.

LA (5 MARKS)

31. *Hints :*

- Isolation of the genetic material of desired character.
- Cutting of DNA at the specific location.
- Amplification of gene using PCR.
- Insertion of DNA into the host cell/organism.
- Obtaining foreign gene product.

For detail refer page no. 201 – 203 NCERT book.

32. (a) Temperature, pH, substrates, salts, vitamins and oxygen.
(b) Figure 11.7 (a) Simple stirred-tank bioreactor, page no. 204 Biology, NCERT book.

- (c) The stirrer facilitates even mixing and oxygen availability throughout simple stirred-tank bioreactor whereas in case of sparged stirred tank bioreactor, air is bubbled throughout the reactor for proper mixing.
33. (i) A – Denaturation
B – Annealing
C – Extension
- (ii) A – Heat denatures DNA to separate complementary strands.
B – Primers hybridizes to the denatured DNA strands.
C – Extension of primers resulting in synthesis of copies of target DNA sequence.
- (iii) Bacterium, *Thermus aquaticus* remains active during the high temperature. It produces enzyme. Taq polymerase which amplifies the DNA. Segment approximately billion times.
34. (1) rop codes for the proteins involved in the replication of plasmid
- (b) Selectable marker – ampicillin resistance gene
- The recombinant plasmid will lose tetracycline resistance due to insertion of foreign DNA, but can still be selected out from non-recombinant ones by plating the transformants on ampicillin containing medium.
- (c) The recombinant DNA can be introduced into *E. coli* cells using the process of transformation in which *E. coli* cells are made 'competent' to take up foreign DNA.

CHAPTER 12

BIOTECHNOLOGY AND ITS APPLICATIONS

POINTS TO REMEMBER

Adenosine Deaminase (ADA) Deficiency : ADA enzyme is crucial for the immune system to function. This disorder is caused due to the deletion of gene for adenosine deaminase enzyme.

Bt Cotton : It is transgenic plant. Bt toxin genes were isolated from *Bacillus thuringiensis* and were incorporated into cotton plant.

Biopiracy : Unauthorised use of biological resources and traditional knowledge related to bioresources for commercial benefits without proper compensatory payments.

Biopesticides : Biological agents that are used to control weeds, insects and other pests.

Cry Gene : The Bt toxins are coded by a gene named cry gene.

Cry Protein : The insecticidal protein which is produced by soil bacterium named *Bacillus thuringiensis* is called cry protein.

C. Peptide : In mammals, including humans, insulin is synthesised as a prohormone which contains an extra stretch called the c peptide. This c-peptide is not present in the mature insulin and is removed during maturation into insulin.

ELISA : Enzyme Linked Immuno-Sorbent Assay is one of the diagnostic technique which is used to detect HIV/AIDS and other diseases.

Genetically Engineered Insulin : The human insulin was prepared by recombinant DNA technology. This insulin has two short polypeptide chains A and B which are linked by disulphide bridges.

Green Revolution : Crop yield has increased tremendously to feed the growing human population.

Genetically Modified Organisms (GMO) : The organisms whose genes have been altered by manipulation are called Genetically Modified Organisms.

Gene Therapy : Gene therapy is a collection of methods that allow correction of a gene defect that has been diagnosed in a child or embryo.

Insecticidal Protein : A toxin in the protein crystal that is secreted by *Bacillus thuringiensis*. It can kill certain insects such as tobacco budworm, armyworm and beetles.

Molecular Diagnosis : Molecular diagnosis is the early detection of diseases which is not possible by traditional diagnostic techniques. These are – Recombinant DNA technology, Polymerase Chain Reaction (PCR) and Enzyme Linked Immuno-Sorbent Assay.

RNA Interference : RNA interference is a process which is used to develop pest resistant plants.

Rosie : In 1997, the first transgenic cow, Rosie, produced human protein (alpha-lactalbumin) enriched milk (2.4 grams per litre).

Sustainable Agriculture : It should use renewable resources, should not cause pollution and maintain optimum yield.

Transgenic Animals : Animals that have had their DNA manipulated by the process and express an extra gene are known as transgenic animals.

Transgenic Crops : Transgenic crops are the crops that contain and express transgene. These crops are also called genetically modified crops or G M Crops. These crops are resistant to insects and capable of producing medical proteins with challenged qualities.

ABBREVIATIONS

ADA	:	Adenosine Deaminase
Bt	:	<i>Bacillus thuringiensis</i>
ds RNA	:	Double stranded RNA
ELISA	:	Enzyme Linked Immuno-sorbent Assay.
GEAC	:	Genetic Engineering Approval Committee.
GMC	:	Genetically Modified Crops
GMO	:	Genetically Modified Organisms.
mRNA	:	Messenger RNA.
PKV	:	Phenylketonuria.
RNAi	:	RNA Interference

QUESTIONS

VSA (1 MARK)

1. Which microorganism is being used to produce the human insulin at commercial scale.
2. Name the nematode that infects the root of tobacco plant and cause a great reduction in yield.
3. Which Indian Variety of rice was patented by an American Company through the US patent and Trademark office?
4. State the principle on which ELISA test is based.
5. Which transgenic food crop may help in solving the problem of night blindness in developing countries?
6. How many polypeptides are found in human insulin?

7. Which two patents on India's biological resources have been revoked?
- *8. Name the insecticidal protein which is produced by *Bacillus thuringiensis*.
- *9. The first transgenic cow, produced human protein-enriched milk. Name the cow and the protein was found in the milk.
- *10. Some biotechnological techniques serve the purpose of early diagnosis of pathogenic diseases before the symptoms appear in the patient. Suggest one of the diagnostic techniques which is based on the amplification of DNA fragment of the patient.

SA - II (2 MARKS)

11. Some crop plants are modified genetically by manipulating their genes. In which way these plants are useful to us?
12. Find the three options that can be thought for increasing food production. Suggest the best option with reason.
13. India is rich in biodiversity and traditional knowledge. What are four reasons for which companies of nations lacking in biodiversity show their interest in Indian market?
14. GEAC is one of the organisations set up by Indian Government. Write its full form. Also give its two objectives.
15. In the following pairs, diagnostic techniques and their applications are given. Which one of these is mismatched and why?
 - (a) **PCR** : detect mutations in genes in suspected cancer patients.
 - (b) **ELISA** : Identification of HIV infected patient using urine samples.
 - (c) **Autoradiography** : allowed to detect mutated genes in a clone of cells.
 - (d) **DNA Microarray** : Analyse the differential gene expression in cancer and normal cells.
16. Enlist four areas which are responsible for the recent advancement in biotechnology.
17. "Industrialised nations are exploiting the bioresources of under industrialised nations". Justify the statement with a suitable example.
18. How transgenic animals can be useful for the treatment of disease like Alzheimer's.
- *19. Which strategy will you suggest to prevent the crop plants from infestation by several nematodes. Name the bacterium that is used as a vector to transfer the gene in this process.
- *20. Name the toxin which is coded by a gene named *cry*. Which organism produces it. How has man exploited this protein for his benefit?

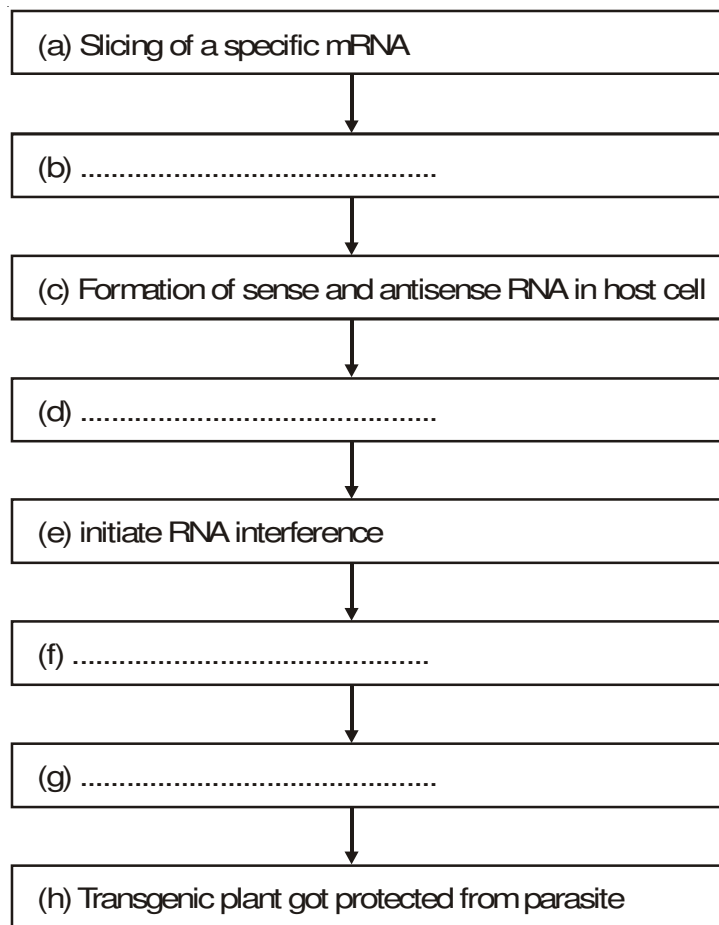
SA - I (3 MARKS)

21. How the use of microbes is important in the control of post and insect diseases in agriculture? Explain with example.

22. "Some nations like India are developing laws to prevent unauthorised exploitation of their bio-resources and traditional knowledge." Support this statement by giving three reasons.
23. Biotechnology is being used to improve the quality of human life. Suggest three critical areas of biotechnology in which more research is needed.
24. Few gaps have been left in the given table, showing certain organisms and their applications. Fill up the gaps.

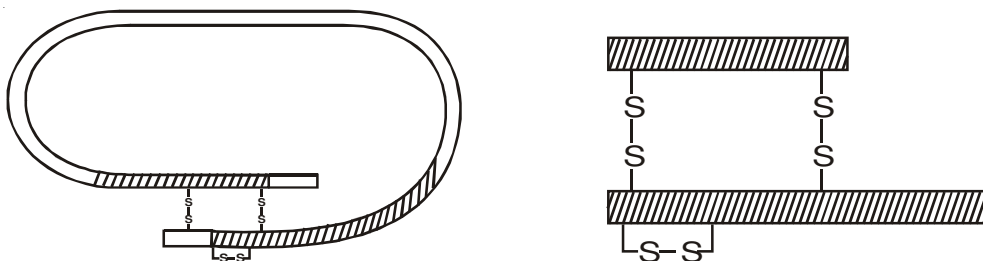
S.No.	Organisms	Applications
(i)	<i>Bacillus thuringiensis</i>	.....
(ii)	.....	Production of human insulin, human growth factors, interferons.
(iii)	Transgenic cow	.....
(iv)	.....	Production of pest resistant dicot plants.
(v)	Transgenic mice	.....
(vi)	.....	Vitamin 'A' enriched rice.

25. Some multinational Companies and other organisations are using bioresources for commercial benefits, without proper authentication and compensation to concern authorities.
- (a) Give the term for this unauthorised act.
- (b) Suggest any two points to prevent it.
26. What are transgenic Crop? Mention any two points of difference between transgenic crop technique and normal breeding technique.
27. The insulin produced using recombinant DNA technology is more advantageous than the insulin extracted from pancreas of slaughtered cattle and pigs. How?
28. Mention any three problems that may arise due to use of genetically modified (GM) food.
- *29. A bacterium produces a toxic protein that is lethal to certain insects but not to themselves.
- (a) Name the strain of bacteria and protein produced.
- (b) Why does this toxin not kill the bacteria?
- (c) What type of changes occur in gut of insect on consuming this protein.
- *30. Given below is an incomplete flow chart showing the process of production of nematode resistant tobacco plants based on RNAi technique.
- (i) Write the missing steps in its proper sequence.
- (ii) At which level RNAi silence the gene.



LA (5 MARKS)

31. In the given figure, Form (A) and Form (B) represents different forms of a proteinaceous hormone secreted by pancreas in mammals.

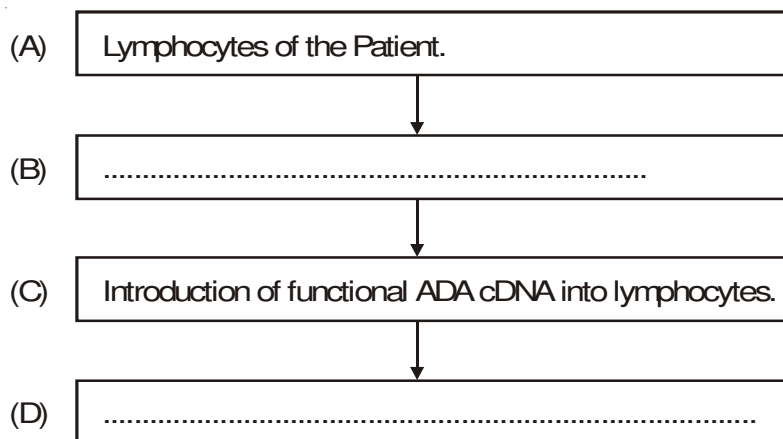


Form 'A'

Form 'B'

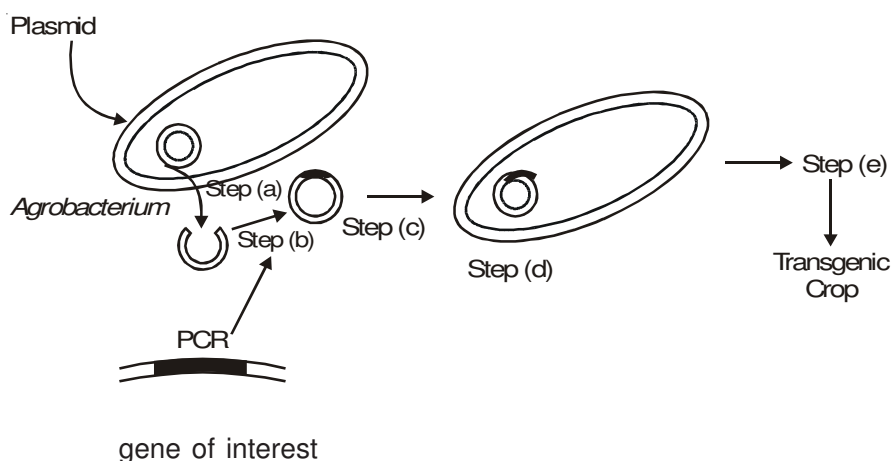
- What type of bonding is present between chains of this hormone.
- What are these form (A) and form (B). How these forms differ from each other.
- Explain how was this hormone produced by Elli Lilly, an American company, using rDNA technology.

32. Why are transgenic animals being produced? How can man be benefited from such modifications?
- *33. The clinical gene therapy is given to a 4 year old patient for an enzyme which is crucial for the immune system to function.



Observe the therapeutical flow chart and give the answers of the following

- Complete the missing steps (B) and (D).
 - Identify the disease which is to be cured.
 - Why the above method is not complete solution to the problem.
 - Scientists had developed a method to cure this disease permanently. Explain.
- *34. In the given figure, *Agrobacterium* is utilized for the production of a transgenic crop. Explain the steps a, b, c, d and e shown in the figure.



- *35. 'The biotechnology can greatly promote human welfare, but it can also be misused to increase human sufferings'. Justify the statement.

ANSWERS

VAS (1 MARKS)

1. *Escherchia coli.*
2. *Meloidegyne incognitia.*
3. Bassmati rice.
4. ELISA is based on the principle of antigen antibody interaction.
5. Golden rice
6. Two.
7. Healing properties of turmeric.
 Pesticides from Neem plants
8. *Cry* protein.
9. Rosie, alpha-lactalbumin.
10. Polymerase Chain Reaction (PCR).

SA – II (2 MARKS)

11. GM crops/are
 - more tolerant to abiotic stresses.
 - per resistant
 - help to reduce post harvest losses.
 - enhance the nutritional value of food.
12. (i) Agrochemical based agriculture
(ii) Organic agriculture.
(iii) Genetically engineered Crop-based agriculture
 - Genetically engineered crop-based agriculture is best option because it minimizes the use of chemical fertilisers.
13. Biodiversity and traditional knowledge can be utilised to:
 - Develop modern applications
 - save time
 - save effort
 - save expenditure.

14. GEAC – Genetic Engineering Approval Committee

Objectives are :

- Make decisions regarding the validity of GM research.
- The safety of introducing GM-organisms for public services.

15. (b) is mismatched pair

- ELISA is used to detect HIV using serum samples.

16. (i) Agriculture

(ii) Food industry

(iii) Medicine

(iv) Environmental Engineering.

17. Industrialised nations are collecting and patenting the genetic resources of under industrialised country like India. An American Company got patent rights on Basmati rice.

- Valuable biomolecules obtained from bioresources are patented and used for commercial purposes.

18. Transgenic animals can be designed to serve as models for human diseases to increase the understanding of genes contributing to the development of disease and thus provide aid in the investigation of new treatments.

19. RNA interference (RNAi)

- Agrobacterium*

20. Bt toxin

- Bacillus thuringiensis*

- Man has developed transgenic crops by introducing this gene from bacteria to crop plants such as Bt cotton and Bt corn.

21. Bt toxin is produced by *Bacillus thuringiensis*. Bt toxin gene has been cloned from the bacteria and been expressed in plants to provide resistance to insects.

- Using *Agrobacterium* Vectors, nematode specific genes are introduced into the host plants. This strategy to control the attack of nematode pests on Crop plants, is based on the process of RNA interference (RNAi),

22. Some nations are developing laws due to :

- (i) growing realisation of the injustice.
- (ii) inadequate compensation given to these nations and
- (iii) benefit sharing between developed and developing nations.

23. Providing the best catalyst in the form of improved organism usually a microbe or pure enzyme.
- Creating optimal conditions through engineering for a catalyst to act.
- Down stream processing technologies to purify the organic compounds.
24. (i) Production of Bt toxin, used as insecticide for crop protection,
- (ii) *Escherchia coli*
- (iii) production of human protein (alpha lactalbumin)
- (iv) *Agrobacterium*
- (v) used to test the safety of the polio vaccine.
- (vi) Golden rice.
25. (a) Biopiracy
- (b) benefits of bioresources should be shared between developed and undeveloped nations.
- Laws should be developed to prevent unauthorized exploitation of their bioresources.
26. A crop that contain and express a transgene is called transgenic Crop or genetically modified (GM) crop.

<i>Transgenic crop</i>	<i>Normal Breeding technique</i>
1. Any gene can be used for transfer.	1. Only those genes can be used that are present in such species that can be hybridized with them.
2. Change in genotype can be controlled.	2. Changes cannot be controlled.

27. Insulin obtained from animal source causes allergy or any other type of reactions to some patients.
- Large amount of insulin can be produced by rDNA technology (saving time and reducing the cost).
- Insulin can be produced without any slaughting animals. So, it prevents from ethical issues.
28. (a) A genetically modified food may produce toxicity.
- (b) Enzymes produced by antibiotic resistant gene may cause allergy.
- (c) The bacteria in the alimentary canal could take up antibiotic resistance gene and they may transfer into resistant to the related antibiotics.
29. (a) *Bacillus thuringiensis*, Bt toxin.
- (b) Bt toxin protein is produced as inactive protoxin.

- (c) Protoxin is converted into active toxin in the presence of alkaline pH of the gut of insects. Toxins create pores in the gut that cause cell swelling and lysis and finally, causes death of the insect.
30. (i) (b) Using *Agrobacterium* as a vector introduces it into tobacco.
- (d) ds RNA (double stranded RNA)
- (f) Silenced specific mRNA of the nematode.
- (g) Parasite could not survive.
- (ii) RNAi silences the gene at translation level.

LA (5 MARKS)

31. (a) Disulfide bonds
- (b) Form (A) – proinsulin
Form (B) – Mature insulin
- Pro-insulin contains an extra stretch called C peptide which is absent in mature insulin.
- (c) Eli Lilly prepared two DNA sequences corresponding to A and B, chains of human insulin and introduced them in plasmids of *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form insulin.
32. ♦ To study normal physiology and development of animals.
- ♦ Study of diseases.
- ♦ Biological products.
- ♦ Vaccine safety.
- ♦ Chemical safety testing.
33. (a) **Step (B)** : Lymphocytes are grown in culture outside the body.
- Step (D)** : Infusion of genetically engineered lymphocytes into the patient,.
- (b) Adenosine deaminase (ADA) deficiency.
- (c) As genetically engineered lymphocytes are not immortal, the patient requires periodic infusion of these cells.
- (d) If the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.
34. **Step (a)** : Plasmid is removed and cut open with restriction endonuclease.
- Step (b)** : Gene of interest is isolated from another organism and amplified using PCR.
- Step (c)** : New gene is inserted into plasmid.

Step (d) : Plasmid is put back into *Agrobacterium*.

Step (e) : *Agrobacterium* based transformation.

35. Biotechnology provides useful products and services by using micro-organisms, such as manufacture of baking powder, alcoholic beverages etc.
- Used in preparing medicines.
- It contribute to sustainable agriculture.

Transgenic Plants and Animals

- Biotechnology can also be misused in the following ways :
- (a) Biotechnological developments favour rich industrialized nations.
 - (b) Biopiracy through biotechnology.
 - (c) Can cause biowar.

CHAPTER 13

ORGANISMS AND POPULATIONS

POINTS TO REMEMBER

Adaptation : Morphological/Physiological/Behavioural change that enables the organism to live successfully and reproduce in its habitat.

Aestivation : Summer sleep. Metabolic activities are suspended, like done during hibernation.

Allen's Rule : Animals that inhabit in very cold climates have shorter extremities like ear, tail etc. to minimize the heat loss.

Ammensalism : Relationship in which one species member is harmed where as other is un-affected.

Biome : Ecosystems of large type.

Commensalism : Relationship in which one species member is benefited but the other member is neither benefited nor harmed.

Carrying Capacity : The maximum population size that an environment can sustain. At this point the population size levels off in the logistic growth model.

Competition : Relationship in which both species members are at loss.

Eurythermals : Organisms that can survive in the wide range of temperature.

Euryhaline : Organisms tolerant of wide range of saline conditions.

Ecology : Study of relationship of interaction between organism and abiotic environment.

Environment : The aggregate of conditions in the surroundings, affecting the existence or development of someone.

Emigration : Permanent departure of individuals from the area under consideration, to somewhere else.

Homeostasis : Organisms try to maintain the constancy of the internal environment.

Hibernation : Winter sleep. The animal goes into hiding during winter and suspend the body activities to the minimum during that period and conserve the energy *e.g.*, All poikilothermal animals like frog, lizard etc.

Immigration : Permanent arrival of individuals to an area after taking birth elsewhere.

Migration : Temporary moving away from the stressful habitat to more hospitable area and return to previous area (by the time stressful period is over).

Mortality : Number of individuals die in a given time.

Mutualism : Relationship in which both species members are benefited.

Natality : Number of births/hatching/germination during a given period and added to initial population.

Osmoconformers : The organisms that do not control the osmotic concentration of their body fluids, but change the osmolarity of the body fluids according to the medium in which they live *e.g.*, Hagfish, stingray etc.

Osmoregulators : The organisms that maintain the internal osmolarity, which is different from the surrounding medium, in which they live *e.g.*, Mammals.

Population : Collection of individuals of a species present in a particular geographical condition.

Population Density : Number of individuals present in per unit area or volume.

Parasite : Organisms getting benefit of space (for living) and nourishment from the host.

Predation : Relationship in which one species member devour the member of other species for food.

Stenothermals : Organisms that can survive in the narrow range of temperature.

Stenohaline : Organisms tolerant of narrow range of saline conditions.

Species : Related individuals which have common ancestry, share similar genetic material, freely interbreed in nature and produce fertile offsprings.

QUESTIONS

VSA (1 MARK)

1. What are the two causes for the seasons to happen?
2. Merely being present in water is not sufficient for an aquatic organism. Name two aspects of water which should be significant for such organisms.
3. Name two physical factors of the atmosphere which can determine a biome (desert/rainforest/tundra).
4. What happens in a competition, when two species interact.
5. Name two parameters which tend to increase the population density.
6. Name two parameters which tend to decrease the population density.
7. Define Darwin's fitness.
8. State competitive exclusion principle/Gause's principle.
9. How does a desert lizard show behavioural adaption in high and low temperature condition.
- *10. Why the maintenance of constant body temperature is significant for the organisms?
- *11. Some organisms migrate temporarily to other places and return back after sometime. Why do they do so?

- *12. A fish of fresh water was shifted to sea and could not survive longer. Suggest the scientific reason for it.
- *13. Birds of Siberia leave their place during extreme winters and return afterwards. Where and why do they usually go?
- *14. Mention one ecological significance of predation.

SA – II (2 MARKS)

- 15. Name two physiological changes in the people living in the mountain areas, which are helpful to adapt in low atmosphere conditions.
- 16. Name the key abiotic factors which lead to the variations in physical and chemical composition of different habitats.
- 17. Mammals living in very cold places need to conserve their body heat. Name any two anatomical changes in these animals which are helpful in reduction in loss of body heat.
- 18. Enlist any four adaptations in desert plants which are helpful in their survival in water deficient (xeric) conditions.
- 19. Suggest way adopted by some mammals to achieve homeostasis in condition of much higher and much lower temperatures than their body temperature.
- 20. Mention two strategies adopted by some of organisms to overcome the stressful conditions for a limited period of time.
- 21. Explain in brief any two models/patterns of population growth.
- 22. Enlist any four needs which make the interaction going between members of different populations.
- 23. Define commensalism. Give one example of it.
- *24. Which component to the spectrum is harmful to the organisms? Submit your view with reason.
- *25. Enlist some attributes that a population does have, and as an individual/organisms does not.
- 26. Natality and immigration both tend to increase the population size. How do these differ in their respective characteristics? Suggest.
- 27. Study the table given below and fill the blanks at (A) to (D).

<i>S.No.</i>	<i>Mean Annual Temperature</i>	<i>Mean Annual Rainfall</i>	<i>Name of Biome</i>
1.	30°C	400 cm	(A)
2.	-10°C	100 cm	(B)
3.	30°C	(C)	Hot desert
4.	(D)	200 cm	Coniferous forest

SA – I (3 MARKS)

28. Define Amensalism. By taking an example of it, write in which way it is different from commensalism.
29. Express the population density in the following cases
 - (a) Single huge banyan tree with large canopy.
 - (b) Fish in a lake.
 - (c) Tiger census in a national park/tiger reserve.
30. Describe the term hibernation, aestivation and diapause with example for each.
- *31. Mention atleast one example from plants and atleast one from animals showing their defence mechanism to save from becoming victim of predation.

LA (5 MARKS)

- *32. Establish the relationship between the surface area and body volume. Suggest the reason that small sized animals are difficult to find in polar regions.
- *33. Predator and herbivores are not different in broad ecological context. Submit your view in this regard. Mention any three ecological services rendered through predation. Why in nature the predators are said to be “prudent”?

ANSWERS

VSA (1 MARK)

1.
 - (i) Revolution of the Earth around the Sun.
 - (ii) Tilt of the Earth on its axis.
2. Salinity and pH.
3. Temperature, and rainfall/snowfall.
4. Both they strive for the same resource.
5. Natality, and immigration.
6. Mortality and emigration.
7. Populations evolve to maximize their reproductive fitness, in the habitat in which they live. Lost efficient reproductive strategy is adopted.
8. Two closely related species sharing common resource cannot co-exist indefinitely. The comparatively inferior in the competition is ultimately eliminated.
9. They warm their body is the Sun. Under high temperature condition, these escape into the shade.
10. Temperature affects the kinetics of enzymes through basal metabolism.

11. They move from stressful habitat to comparatively comfortable and hospitable area.
12. Fish could not adjust with the changed osmotic conditions.
13. Keoladeo national Park/Ghana Bird sanctuary in Bharatpur. Rajasthan. They lay their eggs in comparatively warmer and food rich situation.
14. Energy fixed by green plants during photosynthesis is transferred to higher trophic level. It is the way of nature for transfer of energy.

SA – II (2 MARKS)

15.
 - (i) Increase in production of red blood corpuscles.
 - (ii) Increased breathing rate.
16. Temperature, water, light, soil.
17.
 - (i) Presence of fat layer under the skin, acts as insulation.
 - (ii) Short size of ear, tail, nose and limbs. [Hint refer Allen's rule].
18. Refer page 225, para adaptations, of text book NCERT.
19. When hotter outside, the body releases sweat. Evaporation of sweat causes cooling. Heat is generated by shivering/movement of muscles.
20.
 - (i) Migration
 - (ii) Suspension of active life through hibernation/aestivation/spore formation.
21.
 - (i) Exponential growth-population growth in geometric ratio
 - (ii) Logistic growth population growth upto carrying capacity with enough resources.
22. Food, pollination, space, digestion of complex organic material.
23. Interaction between two organisms in which one species gets benefit but the other is neither harmed nor benefitted e.g. orchid plant growing on the tree as an epiphyte.
24. Ultra violet radiation. Shorter wave length has more energy/penetration capacity in the skin may cause damage to the cells, and skin cancer.
25. Birth rate, death rate, sex ratio, age groups.
26. Mortality pertains to death of individuals at a place (under study). Emigration pertains to departure of members to other place.
27.
 - (a) Tropical forest
 - (b) Arctic and alpine
 - (c) Less than 25 cm
 - (d) 0°C to 15°C

SA - I (3 MARKS)

28. Relationship in which one species is harmed and the other is unaffected *e.g.* A species produces antibiotic chemical (allochemical) which prevents the growth of other species.
29. (a) percent cover in biomass
(b) fish caught per trap
(c) number per unit area.
30. *Hibernation* : Winter sleep to overcome unfavourable condition. Frog go under hiding in winters
Aestivation : Summer sleep to overcome unfavorable condition (deseccation). Lizards also go under hiding during high summers.
Diapause : Zooplankton suspend their development process under unfavourable conditions.
31. (a) *Acacia* develops thorns and escape from predating animals.
(b) Camouflage to avoid easy detection by predator as in chameleon. Monarch butterfly is distasteful because it acquires a chemical by feeding on poisonous weeds.

LA (5 MARKS)

32. Small sized animals have a large surface area. When it is cold outside they tend to loose body heat at faster rate.
To generate more heat, they should have high rate of metabolism at the expanse of energy resource *e.g.* in polar areas. The animals are of large size, so heat loss is reduced.
33. Predator and herbivores are not different in broad ecological context. It is the way of nature to transfer the energy to next higher trophic level.
Population size kept under control by predation. Exotic species are not allowed to spread easily. Predator should be "prudent" meaning that these act with case and have thought for future. If predators over exploit the prey, they themselves will become extinct for lack of food.

CHAPTER 14

ECOSYSTEM

POINTS TO REMEMBER

Climax Community : The stable and final biotic community that develops at the end of ecological succession and is in the perfect harmony with its physical environment.

Detritus : Dead leaves, twigs, algae, animal remains etc. constitute detritus.

Detritivore : Organisms feeding on organic wastes.

Ecological Succession : The successive and orderly replacement of one community by the other community in an area, over a period of time.

Ecological Pyramids : The sequential graphic representation of an ecological parameter (number/biomass/energy) depicting different trophic levels in a food chain.

Ecosystem : Relationship between living organisms and their abiotic surrounding.

Food Chain : The unidirectional representation of transfer of food energy through connected organisms with repeated stages of eating and being eaten.

Food Web : Intermingled food chains in a community constitute food web.

Gross Primary Productivity : Rate of production of organic matter during photosynthesis (GPP).

Net Primary Productivity : Gross primary productivity minus the respiratory losses (NPP).

Primary Productivity : Amount of biomass or organic matter produced by producers per unit area over a period of time.

PAR : Photosynthetically Active Radiation.

Standing Crop : Amount of biomass present in various trophic levels in a population at a given time. (The term applies equally well to plants and animals).

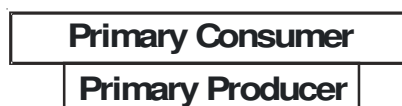
Standing State : The amount of minerals/nutrients present in the soil at a given time.

QUESTIONS

VSA (1 MARK)

1. What is a trophic level?
2. Name a detritivore.
3. Name two climate factors that regulate decomposition process operating through soil microbes.

4. Suggest one word for different levels occupied by different species during their distribution in a community.
5. Name the major reservoir of carbon on the earth.
6. Mention the percentage of photosynthetically active radiation in the incident solar radiation.
- *7. Name the metabolic activity which causes reduction in gross primary productivity.
- *8. Write the other name in ecology for decomposers.
- *9. Name the group of organisms which invade first in a barren past.
- *10. Name a situation in which an ecological pyramid is inverted.
- *11. Name the ecological pyramid which is always upright and never inverted.
- *12. Study the ecological pyramid shown below. Identify and name it. Which one is representing the lesser standing crop.



SA - II (2 MARKS)

13. Mention in brief the two types of primary productivity.
14. Name different functional components of ecosystem which function together as a unit.
15. In the aspect of ecological succession, what a pioneer species and climax community is?
16. Write, what are saprotrophs? Mention their ecological significance.
17. Make comparison for two points between hydrarch succession and xearch succession.
- *18. Mohan said that “animal diet provides more energy.” Submit your view by taking scientific basis in this regard.
- *19. What is standing crop and standing state?
- *20. Why does a plant species is replaced by other species over a period of time during ecological succession. State two reasons for it.
- *21. Make a comparison for two points between primary succession and secondary succession.
- *22. Compare the grazing food chain and detritus food chain in the aspect of their (a) origin (b) energy status.

SA - I (3 MARKS)

23. Enlist any six services provided by an ecosystem.
24. With the help of simple ray diagram, show the cycling of phosphorus in a terrestrial ecosystem.
25. Enlist the different stages involved in primary succession in an aquatic situation.
- *26. Fill in the blanks from (a) to (f) in decomposition process.

(a)..... involves breakdown of detritus into small pieces by detritivores

Water soluble inorganic nutrients go down with soil layers. The process is called (b)

Enzymes of (c) and (d) degrade organic material. The process is called (e)

(f) involves breakdown of detritus into small pieces by detritivores

- *27. Study the table given below and fill the blanks from (a) to (f)

S.No	Component of the Ecosystem	Position of the trophic level	Organism present in the Food chain
1.	E	Fourth trophic level	F
2.	Secondary consumer	D	Bird, fish, wolf.
3.	B	Second trophic level	C
4.	Primary producer	A	Phytoplankton, grass, tree.

LA (5 MARKS)

28. Describe the different steps involved in the process of decomposition of dead remains of plants and animals.

ANSWERS

VSA (1 MARK)

1. Organisms having a feeding relationship with other organisms, in called trophic level.
2. Earthworm (consumes dead and decaying organic matter).

3. Temperature, (soil) moisture.
4. Stratification.
5. Carbon dioxide in atmosphere.
6. 2 – 10%
7. Respiration
8. Saprotrophs
9. Lichens
10. Pyramid of biomass in aquatic ecosystem.
11. Pyramid of energy.
12. Pyramid of biomass in aquatic system. Primary producer represent lesser standing crop.

SA – II (2 MARKS)

13. (i) **Gross Primary Productivity** : The amount of biomass present in different trophic levels in an ecosystem.
 (ii) **Net Primary Productivity** : The remaining amount of biomass left after eliminating the loss in respiration from gross primary productivity.
14. Productivity, decomposition, energy flow, nutrient supply.
15. Pioneer Species : The species which invades first in the barren area.

Climax Community : The community which is present in the end of ecological succession and is in harmony with the environment.

16. Saprotrophs are the organisms which fulfill their energy and nutrient requirement by degrading the organic matter.

	<i>Hydrarch Succession</i>	<i>Search Succession</i>
17.	(i) Starts in water.	(i) Starts on barren rock.
	(ii) Proceeds from hydric (aquatic) to mesic (neither dry nor wet situation)	(ii) Proceeds from xeric (dry) conditions.

18. Animals diet does not provide more energy. On contrary, the vegetable diet provides more energy. The trophic level which is more closer to producer provide more energy. [Hint - Use 10% law for transfer of energy at each trophic level].
19. The amount of living material present in different trophic level at a given time is standing crop. The amount of minerals nutrients present in soil at a given time is called standing state.
20. Each set of organism changes the physical conditions/microclimate thereby making condition unfavorable for itself.

The community that is more complex and more specific in requirements of new situation establishes itself.

21.	<i>Primary Succession</i>	<i>Secondary Succession</i>
	(i) Starts from barren area where no soil was present.	(i) Starts in area where soil is present but biotic communities have been destroyed by fire etc.
	(ii) Competition between species is tough.	(ii) Competition between species is not so tough.
	(iii) Introduction of new species is not easier.	(iii) Introduction of new species is easier.
	(iv) Takes longer time to reach climax (say 1000 years).	(iii) Takes lesser time to reach climax (say 100 years).
22.	(i) Grazing food chain starts from producers. Detritus food chain starts from organic matter.	
	(ii) Grazing food chain is the major conduit of energy flows in an aquatic system.	

SA – I (3 MARKS)

23. Forest (ecosystems) purify water and air,
- Mitigate droughts and floods,
 - Nutrients cycling
 - Generate fertile soil,
 - Provide habitat for wildlife,
 - Pollinate crops,
 - Maintain biodiversity,
 - Storage site for carbon and its products,
 - Provide aesthetic, cultural and spiritual values.
24. Ref. Fig. 14.7 page no. 255 NCERT text book class XII.
25. Phytoplankton,
 Submerged plant stage,
 Submerged free floating plant stage,
 Reed – swamp stage,
 Marsh – meadow stage,
 Scrub stage and then climax forest.

26. (a) fragmentation
(b) leaching
(c) bacteria
(d) fungi
(e) catabolism
(f) mineralisation
27. (a) First trophic level
(b) Primary consumer
(c) Zooplankton, Cow, grasshopper.
(d) Third trophic level.
(e) Tertiary consumer
(f) Man, lion.

LA (5 MARKS)

28. The dead remains of plants and animals called detritus undergo decomposition and converted into simple substances. The steps of this process are :

Fragmentation, Leaching, Catabolism, Humification, Mineralisation.

(Refer Subtopic 14.3 page no. 243 NCERT book.)

CHAPTER 15

BIODIVERSITY AND CONSERVATION

POINTS TO REMEMBER

Biodiversity : The totality of genes, species and ecosystem of a region.

Biosphere Reserve : The area with objective to conserve biological diversity along with their natural ecosystem, ecological and environmental research, both within and adjacent to these reserves, and to provide facilities for education and training.

CITES : Convention on international trade in Endangered species, under auspices of IUCN with aim of regulating trade in endangered species of animals and plants.

Cryopreservation : Preservation in liquid nitrogen at -196°C .

Endangered : Plant or animal species whose number is so few that it is at risk of becoming extinct.

Extinct : No reasonable doubt that the last individual has died.

Endemism : species confined to that region and not found elsewhere.

Ex Situ : Off the site.

IUCN : International Union for Conservation of Nature and Natural Resources.

In Situ : On the actual site.

MAB : Man and Biosphere Program started by UNESCO in 1986.

National Park : Area for wild life where forestry, grazing and cultivation is permitted. Private ownership is not allowed.

Protected Area : An ecological and biographical area in which wild life is conserved, poaching is prevented, natural resources are protected.

Sanctuary : Protected area for wild life where harvesting of timber, collection of minor forest products and private ownership rights are permitted so long as wild life remains in perfect harmony with nature.

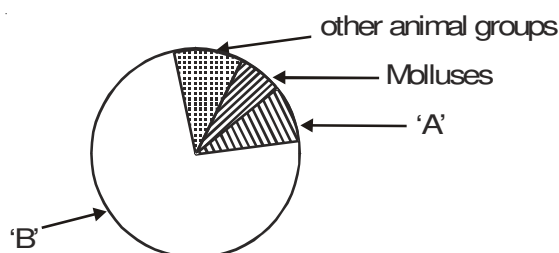
Species : Individuals or members of populations capable of reproducing themselves within the group and produce fertile offspring that morphogenetically resemble their parents.

QUESTIONS

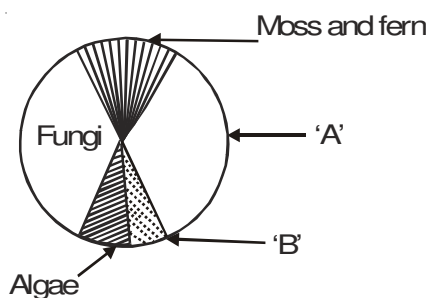
VSA (1 MARK)

1. Name the ecosystem which is facing the most loss of species due to habitat loss and fragmentation.

2. Name the scientist who popularized the term biodiversity.
3. Name the part of the earth which is having greatest biodiversity.
4. What is endemic species?
5. Who proposed the “Rivet popper hypothesis”?
6. Suggest any two strategies involved in the in-situ conservation.
- *7. Study the pie diagram given below and provide the name for the groups among invertebrates shown at ‘A’ and ‘B’ based on their number of species.



- *8. Study the pie diagram of plants given below. Give the name of plant group at ‘A’ and ‘B’ based on their number of species.



- *9. Write two criteria, which is the basis of identification of “Hot spots of biodiversity.”
(High level of species richness, high degree of endemism)

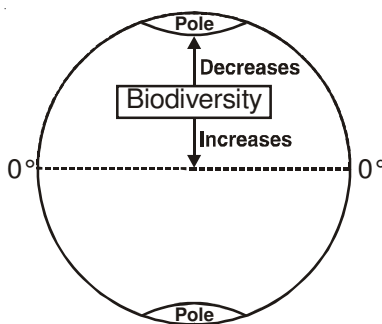
SA – II (2 MARKS)

10. How is the in-situ conservation strategy different from ex-situ conservation strategy?
11. Suggest any two strategies involved in the ex-situ conservation.
12. What quality aspect does a stable community exhibit in regard to productivity and invasion of alien species.
13. Write two observations made by David Tilman in his out door plots experiments.
- *14. Give the relationship of species richness and explored area. Depict this in the form of an equation.
- *15. Give two examples of the extinction of species in last 500 years along with their native place.

- *16. After the five episodes of mass extinctions in the past, we are witnessing the sixth episode. Suggest the aspect in which it is different from the past episodes. Mention the prime cause of the current episode.
- *17. What sort of difficulty do we face in conventional taxonomic categorization of microbes. How do we overcome from this drawback.

SA - I (3 MARKS)

18. Describe three needs which are felt to conserve biodiversity.
19. Describe any three possible consequences followed by loss of biodiversity in a region.
20. Give three reasons/hypotheses that might account for greater biological diversity in tropical areas.
21. "The richness or large variety in a community is related to the functioning of the ecosystem." Provide three view points in its support.
22. Explain the three types of biodiversity existing at different levels of biological organization.
23. Study the diagram of the earth given below. Give the name of the pattern of biodiversity shown therein. Suggest any two reasons for this type of happening.



LA - (5 MARKS)

- *24. Explain reasons for loss of biodiversity, commonly known as "The Evil Quartet." Why do we grieve for the genes when a species is lost?
- *25. Describes at least two approaches each under ex-situ conservations and in situ conservation as a strategy for biodiversity conservation. (In all five approaches to be given).

ANSWERS

VSA (1 MARK)

1. Tropical Rain Forest.
2. Edward Wilson
3. Tropical rain forest Amazon, S. America.

4. Species restricted to a particular area and not found elsewhere in nature.
5. Paul Ehrlich.
6. Protected area like biosphere reserves, national parks, sanctuaries, sacred groves where animals and plants are treated with great respect.
7. A-Crustaceans. B-Insects
8. A-Angiosperms. B-Lichens.
9. High level of species richness, high degree of endemism.

SA – II (2 MARKS)

10. In-situ conservation is done on the site. Ex-situ conservation is done off the site.
11.
 - Creation of zoological parks/botanical gardens/wildlife safari parks.
 - Cryopreservation of gametes.
 - In vitro fertilisation.
 - Creation of seed banks.
 - Propagation through tissue culture.
12. More productivity and resistance to alien species shown by stable community.
13. Plots with more species show less year to year variations in total biomass, also the increased diversity contributed to higher productivity.
14. Richness of the species increases in the increase in the area explored.

In equation from

$$\log S = \log C + Z \log A.$$

15. Dodo – Mauritius
Stelleris sea cow – Russia
16. Faster in rate
Human activities are responsible.
17. Microbes are not culturable under laboratory conditions.
Biochemical and molecular characteristics are accepted.

SA – I (3 MARKS)

18. (i) *Narrow Utilization Aspect* : Humans derive direct benefit from nature in the form of food, fibre, medicine, firewood, industrial products etc. The nations which have rich biodiversity can be more beneficial to reap the benefits.
- (ii) *Broad Utilization Aspect* : Biodiversity plays a major role in the ecosystem services that nature provides viz. Oxygen availability, pollination, aesthetic pleasure etc.
- (iii) *Ethical Aspect* : Each species has its own intrinsic value. It is our moral duty to take care and well being of plants and animals. We must conserve the present for the future of our children.
19. (i) Decline in plant production.
- (ii) Lesser resistance to environmental imbalances like drought and floods.
- (iii) Increased variation in the functioning of ecosystem viz., plant productivity, water use, pest and disease cycles.
20. 3 Reasons :
- (i) For million of years, tropics remain undisturbed but temperate regions had frequent glaciations (ice ages) in the past. More scope of speciation near equator.
- (ii) Environment of tropics relatively constant. Such constancy provides niche specialisation and greater species diversity.
- (iii) Comparatively more solar energy available in tropics led to greater productivity.
21. Richness in a community is related to the functioning of its ecosystem. View points in its support:
- (i) Communities with larger number of species comparatively are more stable.
- (ii) Communities with large number of species show greater resistance to pathogens and invasion of alien species.
- (iii) Increased biodiversity contributes to higher productivity.
22. (i) *Genetic Diversity* : It exists in number, type of genes (alleles) as well as chromosomes present in a species. India has about 50,000 types of rice and about 1000 types of mango.
- (ii) *Species Diversity* : Exists in the richness of different species e.g.. Amphibian species are rich in number in western ghats than in eastern ghats.
- (iii) *Ecological Diversity* : Exists in variety of ecosystems present in large landscape of geographical area viz. deserts, rain forests, mangroves, wetlands, estuaries and alpine etc.
23. Latitudinal gradients
- (i) More solar energy available in tropics, more productivity.
- (ii) Tropical environments are less seasonal, so more practicable.

LA (5 MARKS)

24. "The Evil Quartet" saying states reasons for loss of biodiversity :

- (i) *Habitat loss and fragmentation* : When large habitats are broken up into smaller fragments due to various human activities, the animals requiring large territories (elephants, birds etc.) are badly effected and their populations decline.
- (ii) *Over Exploitation* : When need of a resource becomes greed. Over exploitation of passenger pigeon resulted in its extinction. Similarly marine fish is at brink of being endangered due to over exploitation.
- (iii) *Alien Species Invasion* : Intentional or non-intentional introduction of a species to a nearby area may disturb the harmony of existing species.
- (iv) *Eichhornia* (water hyacinth) after introduction, posed threat to native species.
- (v) *Co-extinction* : Extinction of one species invariably lead to extinction of the other. When host species is extinct, the parasites dependent on it also die.

We grieve for the lost genes, because the wild forms are hardy and more resistant to pathogen attack.

25. *In situ Conservation*

- (i) Identification and maximum protection to hotspots.
- (ii) Legal protection to ecologically rich areas.
- (iii) Biosphere reserves, national parks and sanctuaries.
- (iv) Sacred groves.

Ex situ Conservation

- (i) Creation of zoological parks, botanical garden, wild life safari.
- (ii) Cryopreservation
- (iii) Seed bank.

CHAPTER 16

ENVIRONMENTAL ISSUES

POINTS TO REMEMBER

BOD : Biochemical Oxygen Demand.

CNG : Compressed Natural Gas.

CPCB : Central Pollution Control Board.

Effluents : Something flowing over a large body of water (may be sewage or industrial effluents).

Eutrophication : Nutrient enrichment of water, supports growth of plant and animal life forms, and consequent loss of species diversity.

FOAM : Friends of Arcata Marsh.

Pollution : Undesirable physical/chemical/biological characteristics of air/water/land which cause damage to the animals/plants/humans and architectural structures.

Pollutants : Agents which cause pollution.

Planktons : Free floating, passively drifting organisms in a water body (may be phytoplankton/zooplankton).

Stratosphere : Part of atmosphere between vertical height of 10 to 60 km, lacks dust and moisture, having ozone. Oxygen-ozone inter conversion occurs at expense of UV radiations.

Troposphere : Part of atmosphere between 10 km of vertical height, life supporting region, temperature falls with rise in height, warm air cools as it rises and causes rain etc.

QUESTIONS

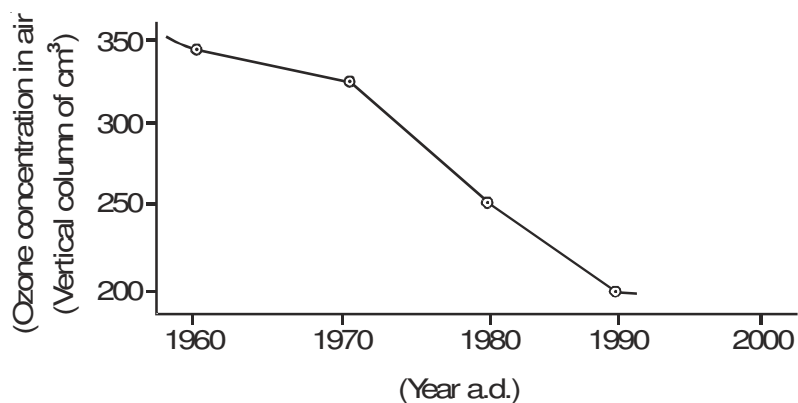
VSA (1 MARK)

1. What is Dobson unit?
2. What is ozone hole?
3. Why the lead free petrol is used?
4. What is the role of catalytic converter?
5. What is algal bloom?
6. Give the scientific name of the aquatic plant also called "terror of Bengal."
7. Define biomagnification.

8. What is the electronic waste (e-waste)?
9. Name the farmer from Sonipat who is promoting organic farming.
- *10. What could be the measure of biochemical oxygen demand at the point of discharge of sewage in the water?

SA - II (2 MARKS)

11. Suggest two ways to remove pollutants in the air.
12. Enlist any four disorders caused by noise pollution.
13. Suggest any four way to reduce the noise pollution.
14. What is the cause of algal bloom? Mention any two harmful effects of it.
15. Suggest the main steps involved in the integrated water management.
16. How the e-waste is treated?
17. What is Montreal Protocol? What is the significant aspect of it?
- *18. Establish the relation between eutrophication and cultural/accelerated eutrophication.
- *19. Study the graph given below and suggest the name for the happening shown there in. Suggest control measures to reduce this effect.



SA - I (3 MARKS)

20. Suggest any three ways to spread the awareness regarding conservation of forests by people's participation.
21. Enlist the consequences of deforestation.
22. Enlist any six sufferings caused to humans due to widening of ozone hole.
23. Mention any six benefits arising out of organic farming.

24. Enlist four harmful effects caused to the humans by living in polluted air. Suggest any two measures to reduce air pollution.
- *25. Fill in the blanks in the following events from (a) to (f).

Lake is young, water is cold. Supports life. With time, streams are draining into lake and add nutrients.

Concourages growth of (a) organisms.
Fertility increases, plant and animal life (b)
Organic remains begin to deposit at (c)
Over centuries (d) and organic debris pile up
Lake grows shallower and become (e).....
Marsh plants take root, begin to fill in original lake base
Ultimately lake gives way to masses of floating plants. Finally converts into (f).....

LA - (5 MARKS)

- *26. What is ozone hole? Describe the steps leading to ozone depletion in the stratosphere. What should be done to minimise the damage to the ozone layer?
- *27. Give the relative proportion of green house gases. Mention any three suspected harm to the environment that the gases may cause (due to global warming).

ANSWERS

VSA (1 MARK)

1. Measure of thickness of ozone in vertical column of air.
2. Part of the atmosphere having thinned ozone layer called ozone hole.
3. Lead coming out form automobile exhaust can cause respiratory and other health problems.
4. Catalytic converters catalyse the conversion of un-burnt hydrocarbon into carbon dioxide and water.
5. Excessive growth of planktonic (free floating) algae due to excessive nutrients in the lake.
6. *Eichhornia crassipes*.
7. Increases in the amount of toxic substances in successive food level.

8. Ir-repairable computers and other electronic goods.
9. Ramesh Chandra Dagar.
10. BOD rises at this point.

SA - II (2 MARKS)

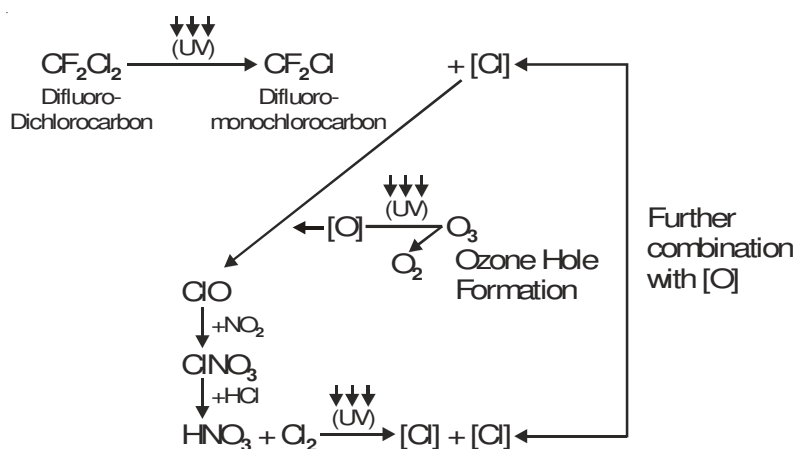
11. *Electrostatic Precipitators* : The charged particles are electrically neutralized and separated from polluted air.

Scrubbers : Polluted air is passed through a spray of water or lime and gases present in air are removed.

12. Sleeplessness, increased heart beat, altered breathing pattern, impaired hearing, permanent loss of hearing.
13. Noise mufflers, sound absorbing materials, horn free zones, regulated timing to play loudspeakers.
14. Large amounts of nutrients present in water body causes excessive growth of algae, called algal bloom. Harmful effects. Fish mortality, deterioration in fish quality, toxic to humans and animals.
15. Sedimentation, filtration, chlorination of water absorption and assimilation of pollutants by algae, fungi and bacteria.
16. Bury or incinerate. Recovery of metals and its recycling.
17. International treaty signed at Montreal (Canada) in 1987 (effective from 1989).

Reducing the harmful effects of ozone depletion. Separate directives for developed and developing countries to reduce CFC and other ozone depleting substances.

18. Eutrophication is the process of natural ageing of the lake. Addition of sewage or industrial pollutants into the lake accelerate the ageing of the lake. It is called cultural or accelerated eutrophication.
19. Ozone hole formation. Minimise the use of Chlorofluorocarbons. [Hint – Schematic representation of the ozone hole formation].



SA - I (3 MARKS)

20. People's involvement in the conservation of forests is the need of the time. Various movements and awards have been initiated.

Amrita Devi Bishnoi Wildlife Protection Award : It is given to individuals or communities from rural areas having shown extra ordinary courage and dedication in protecting wildlife.

Chipko Movement : People of Garhwal protected trees from the axe of contractors by hugging the trees, when the tree were about to cut.

Joint Forest Management : Govt. agencies work closely with local people in managing and protecting the forests. Forest produce is shared with people and forests are conserved in sustainable manner.

21. Enhanced CO₂ concentration in atmosphere. Loss of biodiversity, soil erosion. Desertification, Disturbed hydrological cycles.

22. DNA mutation due to UV rays.

Skin cancer

Cataract

Inflammation of cornea.

Permanent corneal damage.

Skin ageing

23. Zero waste procedure.

Maximum utilization of resources.

Nutrients are recycled

Cyclical process

Less dependence on chemical fertilizers.

Increased production efficiency.

Extremely economical.

Sustainable venture.

24. Breathing problems.

Irritation and inflammation.

Damage to lungs.

Premature death.

Reduction of air pollution : Control the quality of emission of automobile exhaust, growing more trees/afforestation.

25. (a) Aquatic

(b) Begins to grow rapidly

(c) Bottom of lake

(d) Silt

(e) Warmer

(f) Land

LA (5 MARKS)

26. The part of the atmosphere where ozone is present in lesser concentration is called ozone hole. (It is largely observed above Antarctica).

Steps :

- CFC used in refrigeration leaks, and goes into upper layers of atmosphere.
- UV rays split CFC and release atomic [Cl].
- [Cl] traps [O] and ozone is not formed again from oxygen.
- UV rays also split ozone into O_2 and [O]. $O_3 \rightleftharpoons O_2 + [O]$
- [Cl] traps [O] again and ozone is not formed.
- Depletion of ozone in the stratosphere.

Under Montreal protocol (1987, 1989), separate guidelines for developing and developed countries to minimize the release of CFC and other ozone depleting substances.

27. CO_2 – 60%

CH_4 – 20%

CFC – 14%

Others – 4%

- (i) Odd climatic changes.
- (ii) El Nino effect.
- (iii) Melting of polar ice caps and snow.
- (iv) Rise in sea level.
- (v) Coastal areas may submerge.

CLASS XII

DESIGN OF THE QUESTION PAPER : BIOLOGY

Time : 3 Hrs.

Max Marks : 70

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows :

A. Weightage to Content/Subject Units

<i>Unit</i>	<i>Content</i>	<i>Marks</i>
1.	Reproduction	14
2.	Genetics and evolution	18
3.	Biology and human welfare	14
4.	Biotechnology and its applications	10
5.	Ecology and environment	14
Total		70

3. Weightage to Different forms of Questions

<i>S. No.</i>	<i>Form of Questions</i>	<i>Marks for each</i>	<i>No. of Questions</i>	<i>Total Marks Questions</i>
1.	Very Short Answer (VSA)	1	8	08
2.	Short Answer (SA II)	2	10	20
3.	Short Answer (SA I)	3	09	27
4.	Long Answer Type (LA)	–	3	15
Total		–	30	70

4. Scheme of Options

- There will be no overall option.
- Internal choices (either/or type) on a very selective basis has been provided. This choice has been given in any one questions of 2 marks, any one question of 3 marks and all the three questions of 5 marks weightage.

3. Weightage to Difficulty Levels of Questions

<i>S. No.</i>	<i>Estimated Difficulty Level</i>	<i>Percentage</i>
1.	Easy	15
2.	Average	70
3.	Difficult	15

A question may vary in difficulty level from individual to individual. As such, the approximation in respect of each question will be made by the paper setter on the basis of general expectation from the group as a whole. The provision is only to make the paper balanced in nature rather than to determine the pattern of making at any stage.

CLASS XII

BLUE PRINT

Time : 3 Hrs.

Max Marks : 70

<i>Type of Questions Unit</i>	<i>VSA</i>	<i>SA II</i>	<i>SA I</i>	<i>LA</i>	<i>Total</i>
1. Reproduction	2 ₍₂₎	6 ₍₃₎	6 ₍₂₎	–	14 ₍₇₎
2. Genetics and evolution	2 ₍₂₎	2 ₍₁₎	9 ₍₃₎	5 ₍₁₎	18 ₍₇₎
3. Biology and human welfare	2 ₍₂₎	4 ₍₂₎	3 ₍₁₎	5 ₍₁₎	14 ₍₆₎
4. Biotechnology and its applications	1 ₍₁₎	–	9 ₍₃₎	–	10 ₍₄₎
5. Ecology and environment	1 ₍₁₎	8 ₍₄₎	–	5 ₍₁₎	14 ₍₆₎
Total	8₍₈₎	20₍₁₀₎	27₍₉₎	15₍₃₎	70₍₃₀₎

CLASS XII

MODEL PAPER – 1 (Solved) : BIOLOGY

Time : 3 hours

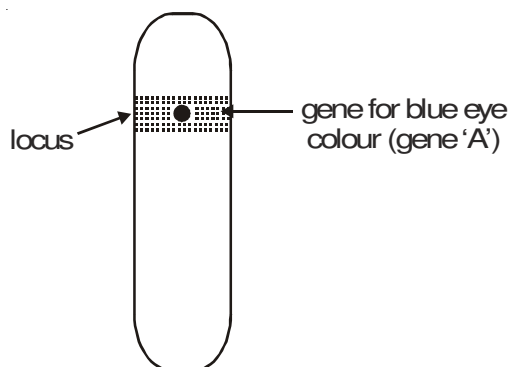
Maximum Marks : 70

General Instructions :

1. All questions are compulsory.
2. This question paper consists of four sections A, B, C and D. Section A contains questions of 1 mark each. Section B is of 10 questions of 2 marks each. Section C has 9 questions of 3 marks each, whereas section D is of 3 questions of 5 marks each.
3. There is no overall choice. However an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternative in such questions.
4. Wherever necessary, the diagrams drawn should be neat and properly labelled.

SECTION A

1. Mention two reasons for which an organism adapts to its environment.
2. Provide name to the morphologically and genetically identical organisms.
3. Ramu consumed contaminated water and suffered abdominal pain and cramps, stool with mucous and blood. Name the disease he is suffering from.
4. A bisexual flower is made female flower by surgical removal of its anthers. Provide name for this technique.
5. Certain pollen grains can withstand extremes of weather conditions and remain alive for many years. Name the substance on the pollen grain that makes such happening possible.
6. What extra does the genome of a genetically modified organism, (GMO) have? Name it.
7. Expand the term MALT.
8. Study the diagram given below. Provide the term used for the gone 'B', as used in genetics.



Chromosome

(●)
gene for brown eye colour (gene 'B')
can alternatively replace gene 'A'
on the same locus.

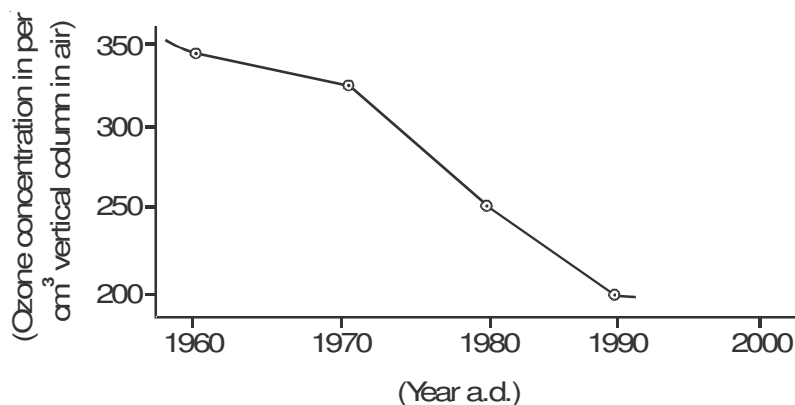
SECTION B

- Give any four reasons in support that the survival rate is more in case of viviparous animals (which give birth) than that of oviparous animals (which lay eggs).
- By taking an example of each, differentiate between a detritivore and a decomposer.
- Sperm is small in size and has a tail. Ovum is large in size and does not have tail. Give reason.
- Submit any four reasons that tobacco should not be taken in any form as it is injurious to health.
- Thermal power plants cause harm to the environment. Name any three such harms. Suggest one precautionary measure to reduce harm through thermal plant.
- Ramu with blood group A marries Renu with blood group B. One of their child showed AB blood group, while other child had blood group O. Make a genetic cross and show the genotype of all the family members.

OR

If length of DNA is 1.36 nm and the distance between successive base pair is 0.34×10^{-9} m. Calculate the number of base pairs in the DNA molecule.

- Study the graph shown below and suggest the name for the happening shown therein. Suggest any two control measures to reduce this effect.



- Surgical removal of testes in human male cant be taken as a step toward birth control. Submit your views is this regard.
- Name the two quality aspects present in the plant and are required for breeding purposes. Our country had manifold increase in food production by using these aspects. What name was assigned to this phase of plant production. Name the semi-dwarf wheat variety used during this period.
- Enlist any four benefits rendered by the fungus while having symbiotic association with root of higher plants.

SECTION C

19. The neck of Giraffe elongated over a period of time. Explain this on the line of Lamarckian and Darwinian thought.
20. Write the steps involved from separation to visualisation of DNA fragments in agarose gel electrophoresis.
21. Give any three reasons showing superiority of sexual reproduction over asexual reproduction.
22. Write about the location and expressive nature of haemophilia gene. With the help of a cross, depict the formation of haemophilic female.

OR

Base sequence on a DNA strand is 5' – CAAGG TATA CC GAC – 3'

- (i) Write the base sequence on mRNA strand using DNA as template.
 - (ii) The adenine at second place toward 5' end is replaced by thymine. Write the base sequence on m-RNA strand after change.
 - (iii) No different protein was formed even after base(s) change in DNA. Give reason for it.
23. Draw a diagrammatic sectional view of a seminiferous tubule and label the cells.
 24. Suggest any three areas of agriculture where an agricultural scientist can be successful in improving the crop through gene manipulation.
 25. During transcription process, the events like splicing, capping, tailing occur. Write in brief about these events.
 26. Fill in the blanks from (a) to (f), given below.

For human and animals, SCP is an alternate source of proteins, better known as

(a)

It is rich in (b) and (c)

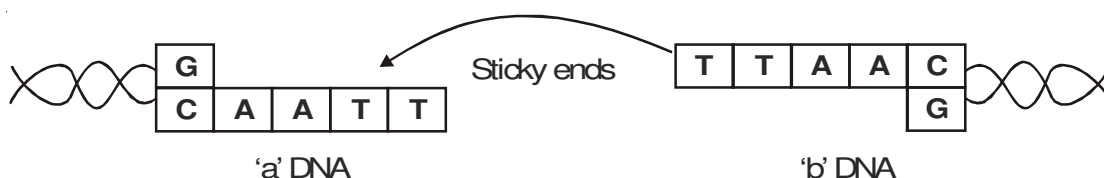
can be grown on (d)

the popular example of SCP is (e)

Besides being nutritionally rich, SCP is also helpful in reducing (f)

27. Study the diagram shown below and answer the questions :
 - (i) Name the DNA shown at 'a' and 'b'.
 - (ii) Name the enzyme which recognises the site of exact cut.

- (iii) Name the enzyme that joins the DNA fragments.
- (iv) Draw the diagram of DNA after the ligation showing the polarity of strands.



SECTION D

28. An enlightened farmer from Sonipat is spreading message of organic farming. Name the different activities he has added in his programme. Enlist any six benefits arising out of it.

OR

Define latitudinal gradients and give examples. Provide three explanations to this phenomenon.

29. Define codominance. Take example from humans and explain its basis.

OR

Enlist the steps in sequence showing degradation of lactose in bacterial model of Lac operon.

30. A scientist wish to combine characteristics of two plants by fusion of diploid cells. Suggest name of the technique he should employ. Take an example of it and give steps of the procedure.

OR

Cells in a tissue has lost the property of contact inhibition. What should be the consequence? Enlist any six properties by such cells showing deviation from normal cells. Other than surgery, suggest any two procedures for the correction of such disorders.

CLASS XII

MARKING SCHEME : VALUE POINT

SECTION A

- | | |
|--|---------------------------------|
| 1. Survival, reproduction. | $\frac{1}{2} + \frac{1}{2} = 1$ |
| 2. Clone | 1 |
| 3. Amoebiasis/Amoebic dysentery. | 1 |
| 4. Emasculation | 1 |
| 5. Sporopollenin | 1 |
| 6. Foreign gene/gene of other organisms. | 1 |
| 7. Mucosal associated lymphoid tissue. | 1 |
| 8. Allele | 1 |

SECTION B

9. (a) Development inside mother's body.
(b) Protection from predators.
(c) Better chances of fusion of gametes.
(d) Good parental care. $\frac{1}{2} \times 4 = 2$
10. *Detritivore* : Feed on detritus/dead remains of plants and animals example—earth worm/nematode. $\frac{1}{2} + \frac{1}{2} = 1$
Decomposer : Convert complex (organic) matter into simpler (inorganic) form example— Bacteria/ fungus. $\frac{1}{2} + \frac{1}{2} = 1$
11. *Sperm* : Motile, need to reach fast to ovum.
Ovum : Non motile, more of stored substances in cytoplasm. $1\frac{1}{2} \times 4 = 2$
12.
 - Causes cancer of lung/throat/oral cavity/urinary bladder.
 - Bronchitis
 - Emphysema
 - Gastric ulcer
 - Raises CO level in blood/lower oxygen carrying capacity.

- Nicotine is stimulant and addictive (any four). $\frac{1}{2} \times 4 = 2$
- 13.
- Release of gaseous and particulate pollutants.
 - Release of hot water kill aquatic life forms.
 - Loss of indigenous flora and fauna. $\frac{1}{2} \times 3 = 1\frac{1}{2}$
 - Use of electrostatic precipitators. $\frac{1}{2} = 2$
- 14.
- Genotype of Ramu Aⁱ
 - Genotype of Renu Bⁱ
 - Genotype of one child AB
 - Genotype of other child ii $\frac{1}{2} \times 4 = 2$
- OR
- Length of molecule = number of base pairs \times distance between base pair. $\frac{1}{2}$
 - $1.36 \times 10^{-3} = \text{number base pairs} \times 0.34 \times 10^{-9}$ $\frac{1}{2}$
 - Number of base pairs = $\frac{1.36 \times 10^{-3}}{0.34 \times 10^{-9}}$ $\frac{1}{2}$
 - Number of base pairs = 4×10^6 $\frac{1}{2}$
- 15.
- Ozone hole formation 1
 - (Depletion of ozone) $\frac{1}{2}$
 - (i) Control on release of ozone depleting substances. $\frac{1}{2}$
 - (ii) Less use of chlorofluorocarbons/replacement of CFC in refrigeration. $\frac{1}{2}$
- 16.
- Permanent infertility
 - Affect on sexual desire
 - Docility
 - Testosterone not available to body. $\frac{1}{2} \times 4 = 2$
- 17.
- High yield and disease resistance. 1
 - Green revolution. $\frac{1}{2}$
 - Sonalika/Kalyan Sona $\frac{1}{2}$
- 18.
- Absorption of phosphorus from soil.
 - Resistance to root borne pathogens.
 - Tolerance to salinity and drought.
 - Overall increase in plant growth. $\frac{1}{2} \times 4 = 2$

SECTION C

19. *Lamarckian thought* : Use and disuse of organ, more stretching of neck, gradually elongated over generations. $\frac{1}{2} \times 3 = 1\frac{1}{2}$

Darwinian thought : Giraffe with longer neck was in more advantageous position, natural selection, advantageous got selected and propagated.

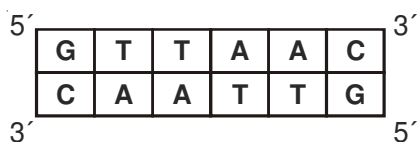
20. (a) DNA cut by restriction enzymes.
(b) DNA fragments move in agarose gel matrix.
(c) DNA polarised toward anode.
(d) DNA fragments resolve according to their size.
(e) DNA stained with ethidium bromide.
(f) DNA fragments visualised under UV light. $\frac{1}{2} \times 6 = 3$
21. (i) More genetic variations produced, so evolution occurs. 1
(ii) More adaptive value, better survival. 1
(iii) gamete formation, a pre-requisite. 1
22. Recessive gene on x-chromosome, mother carrier and father haemophilic, one haemophilia gene from mother/carrier, one haemophilia gene on x-chromosome of father, union of haemophilia genes from both parents. $\frac{1}{2} \times 6 = 3$

OR

- (i) 5' – GUU CCA UAU GG CUG–3' 1
(ii) 5' – GUA CCA UAU GG CUG – 3' 1
(iii) Codon still codes for similar amino acid even after the change. 1
23. Correct labels Fig. 3.5 Page 47 NCERT Class XII. $\frac{1}{2} \times 6 = 3$
24. (a) Tolerance to abiotic stress/tolerance to cold, drought, salt, heat.
(b) Pest resistant crop/less dependence on chemical pesticides.
(c) Reduction in post harvest loss.
(d) Increased efficiency of mineral usage/prevention of early exhaustion of soil fertility.
(e) Enhanced nutritional quality/vitamin A enriched rice. (*Any three*) $1 \times 3 = 3$
25. *Splicing* : Removal of introns and joining of exons. 1
Capping : Addition of methyl guanosine triphosphate at 5' end of RNA. 1
Tailing : Addition of adenylate residues at 3' end of hnRNA. 1

26. (a) Single cell protein.
 (b) Carbohydrates
 (c) Vitamins
 (d) Straw/molasses/animal manure/sewerage
 (e) *Spirulina*
 (f) Environmental pollution. 1/2 × 6 = 3

27. (i) 'a' DNA – Vector DNA 1/2
 'b' DNA – Foreign DNA 1/2
 (ii) EcoRI 1/2
 (iii) DNA ligase 1/2
 (iv)



1

OR



1

SECTION D

28. Bee keeping, dairy management, water harvesting, composting and agriculture 1/2 × 4 = 2
- (i) Nutrients are recycled.
 (ii) Zero waste procedure.
 (iii) Maximum utilisation of resources.
 (iv) Cyclical process.
 (v) Less dependence on chemical fertilisers.
 (vi) Sustainable venture.
 (vii) Increased production efficiency.
 (viii) Extremely economical. (*Any Six*) 1/2 × 6 = 3

OR

Species diversity decline as we move from equator to poles.

1

Columbia near equator has 1400 bird species, Greenland near pole has 56 bird species. 1

Reasons : (i) For millions of years equator protected from ice ages. 1

(ii) More constant seasons at equator. 1

(iii) More productivity at equator due to more available solar radiation. 1

29. F_1 resemble both the parents.

- ABO blood group system controlled by I gene. $\frac{1}{2}$
- I^A , I^B , I^i alleles of I gene.
- I^A and I^B produce different sugar polymers.
- I^i does not produce sugar polymer.
- Sugar polymers present on surface of RBC.
- Alleles of I gene produce 6 types of genotypes.
- Alleles of I gene produce 4 types of phenotypes/blood groups.
- I^A and I^B both equal is expression/both dominant/co-dominant. $\frac{1}{2} \times 7 = 3\frac{1}{2}$

OR

- Z, Y and a are structural genes.
- Gene i produces repressor.
- Z gene produces β -galactosidase.
- Y gene produces permease.
- a gene codes for transacetylase.
- Binding of repressor to operator gene stops structural genes to transcribe.
- Lactose acts as inducer.
- Repressor inactivated after binding to lactose.
- RNA polymerase makes access to promoter and structural genes start transcribing.
- β -galactosidase degrade lactose into glucose and galactose. $\frac{1}{2} \times 10 = 5$

30. Somatic hybridisation

- Protoplast of tomato, protoplast of potato, fusion of both protoplast (cells), formation of tomato. $\frac{1}{2} \times 4 = 2$
- Isolation of single cell(s) from parent.
- Digestion of cell wall.

- Fusion of protoplast(s) cells.
- Hybrid cell.

$$\frac{1}{2} \times 4 = 2$$

OR

Uncontrolled cell division/formation of tumor/overgrowth/neoplasia.

1

- Cells grow very rapidly.
- Invade and damage the surrounding tissue.
- Rapid cell division.
- Normal cells compete for nutrients and starve.
- Cells slough off and begin to move/metastasis.
- Sloughed cells lodge at other site.

$$\frac{1}{2} \times 6 = 3$$

Radiotherapy / immunotherapy / chemotherapy / α -interferon (*any two*)

$$\frac{1}{2} \times 2 = 1$$

MODEL TEST PAPER : BIOLOGY (Theory)

Time : 3 hours

Maximum Marks : 70

General Instructions :

- (i) All questions are compulsory
- (ii) This question paper consists of four sections A, B, C, and D. Section A contains questions of 1 mark each. Section B is of 10 question of 2 marks each, section C has 9 question of 3 marks each, whereas section D is of 3 questions of 5 marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.
- (iv) Wherever necessary, the diagrams drawn should be neat and properly labeled.

SECTION A

1. Stem cutting of rose plant was put into soil for vegetative propagation. Name the part of the cutting from which new roots will arise. 1
2. Mention the situation in which an ecological pyramid becomes inverted. Identify the category of pyramid. $\frac{1}{2} \times \frac{1}{2} = 1$
3. Fill in the blank. After full processing the heterogenous nuclear ribose nucleic acid becomes 1
4. Name the enzyme that has the ability to make precise cut in the DNA. 1
5. Expand the term GEAC. 1
6. What the alternate form of the gene, present on the same locus on the chromosome, is called as? 1
7. Name the content of the mother's milk which provides immunity to the child against diseases. 1
8. A plant is not promoting self-pollination. Name two features present in flower which are helpful in this regard. $\frac{1}{2} \times \frac{1}{2} = 1$

SECTION B

9. A plant is not having symbiotic association called mycorrhiza. Enlist four disadvantages that this plant is likely to suffer. $\frac{1}{2} \times 4 = 2$
10. Give any four features present in flower which facilitate pollination through insects. $\frac{1}{2} \times 4 = 2$

11. How the different seasons are caused? 1 + 1 = 2
12. A fish living successfully in the Indian ocean accidentally drifted into river Ganges and died a few minutes later. Give most plausible reason for both the situations. 1 + 1 = 2
13. What is amniocentesis? In what aspect this technique should not be practised? 1 + 1 = 2
14. Provide two strategies each for insitu and exsitu conservation of biodiversity. 1 + 1 = 2
15. S.L. Miller obtained amino acids in the flask from electric discharge containing mixture of CH_4 , NH_3 , H_2O , N_2 . What was he trying to prove through his experiment? Name the scientists whose view prompted the Miller to conduct the experiment. 1 + 1 = 2
16. Enlist any four reasons that a person is inclined to take more of substance/drug of abuse and becomes addict to it. $\frac{1}{2} \times 4 = 2$

OR

- Enlist any four methods/techniques to detect the cancer in the body. $\frac{1}{2} \times 4 = 2$
17. Arrange the following terms in their correct sequence of development pollen grain, sporogenous tissue, microspore tetrad, pollen mother cell. $\frac{1}{2} \times 4 = 2$
18. Mention any four benefits arising out of spiciculture. $\frac{1}{2} \times 4 = 2$

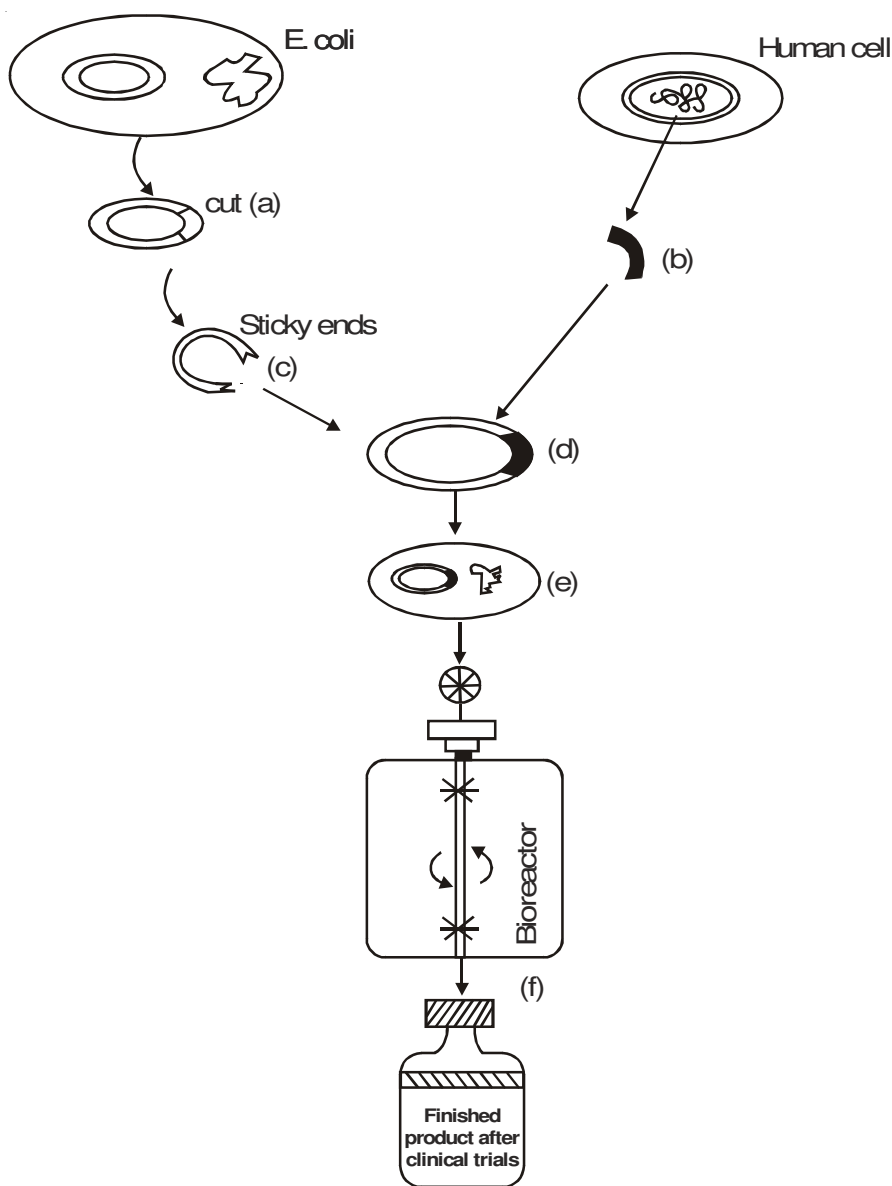
SECTION C

19. Sonu has brown eyes (heterozygous for the character) and his mother has blue eyes. Assuming that the brown eye colour is dominant over blue eye colour work out a genetic cross and mention the genotype of—
- (a) Sonu and his mother. 1
- (b) Possible genotype of his father, with reason. $\frac{1}{2} + \frac{1}{2} = 1$
- (c) If Sonu marries a lady with blue eye colour, the possible proportion of eye colour of his children. 1
20. The ovary ripens and becomes fruit. Even some fruits are called true fruit, false fruit and parthenocarpic fruit. Explain in brief the basis of such classification. 1 × 3 = 3

OR

- A person does not wish to contract any sexually transmitted disease (STD) and suffer later. Suggest any three ways/methods that should be practised in this regard. 1 × 3 = 3
21. Draw a labelled diagram of an antibody molecule and label heavy chain, light chain, disulfide bond, antigenbinding site. Which type of response does the antibody molecule represent? Name it. $\frac{1}{2} \times 4 = 2$
22. Enlist any six major goals of Human Genome Project (HGP). $\frac{1}{2} \times 6 = 3$

23. Certain strains of bacteria are producing proteins which are lethal to insects, but not to themselves. Give reason for this. Write the changes that happen inside the gut of insects which turn the protein into lethal form. $\frac{1}{2} \times 6 = 3$
24. Mention any three qualities/characteristics that a gene must have. $1 \times 3 = 3$
25. What is a cloning vector in genetic engineering? Enlist four characteristics that a cloning vector must have? $\frac{1}{2} \times 4 = 2$
26. Give any three plants of difference between angiospermic male gametophyte and female gametophyte. $1 \times 3 = 3$
27. Study the stages of gene transfer shown below and name the stages shown at (a) to (f)



$\frac{1}{2} \times 6 = 3$

SECTION D

28. Sometimes we feel that a herbivore and a predator are not different in broad ecological context. Justify this statement. Mention any three ecological services rendered through predation. Submit your viewpoint that a predator has to be “prudent” in nature. 1 + 3 + 1 = 5

OR

Describe stepwise the process of decomposition of dead remains of plant and animals.

1 × 5 = 5

29. When DNA replicates, one strand is newly formed while the other strand is the old one. What this type of formation is called as? Who performed the experiment showing such replication. Describe the experiment. $\frac{1}{2} \times 10 = 5$

OR

Enlist the steps in sequence involved in the process of replication of molecule of DNA.

1 × 5 = 5

30. Describe the process of biological treatment/secondary treatment of sewage. 1 × 5 = 5

OR

We usually remain healthy inspite of being surrounded by disease causing agents present in the air/water/soil. What are the different barriers in our body which resist the disease causing agents? Explain in brief. Sometimes the immune system of the body does not work effectively and the body cells begin to work against on own cells. Name one such disorder. 1 × 4 + 1 = 5