

केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर
Kendriya Vidyalaya Sangathan Regional Office Raipur



Class - XII
Multiple Choice Question Bank
[MCQ] Term - I

Biology [044]
Based on Latest CBSE Exam Pattern
for the Session 2021-22

केन्द्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर

Kendriya Vidyalaya Sangathan Regional Office Raipur

MESSAGE FROM DUPUTY COMMISSIONER



It is a matter of great pleasure for me to publish study material for different subjects of classes X and XII for Raipur Region. Getting acquainted and familiarized with the recent changes in curriculum and assessment process made by CBSE vide Circular No. 51 and 53 issued in the month of July 2021 will help students to prepare themselves better for the examination. Sound and deeper knowledge of the Units and Chapters is must for grasping the concepts, understanding the questions. Study materials help in making suitable and effective notes for quick revision just before the examination.

Due to the unprecedented circumstances of COVID-19 pandemic the students and the teachers are getting very limited opportunity to interact face to face in the classes. In such a situation the supervised and especially prepared value points will help the students to develop their understanding and analytical skills together. The students will be benefitted immensely after going through the question bank and practice papers. The study materials will build a special bond and act as connecting link between the teachers and the students as both can undertake a guided and experiential learning simultaneously. It will help the students develop the habit of exploring and analyzing the **Creative & Critical Thinking Skills**. The new concepts introduced in the question pattern related to case study, reasoning and ascertain will empower the students to take independent decision on different situational problems. The different study materials are designed in such a manner to help the students in their self-learning pace. It emphasizes the great pedagogical dictum that '*everything can be learnt but nothing can be taught*'. The self-motivated learning as well as supervised classes will together help them achieve the new academic heights.

I would like to extend my sincere gratitude to all the principals and the teachers who have relentlessly striven for completion of the project of preparing study materials for all the subjects. Their enormous contribution in making this project successful is praiseworthy.

Happy learning and best of luck!

Vinod Kumar
(Deputy Commissioner)

Our Patorn



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KENDRIYA VIDYALAYA SANGATHAN, RAIPUR REGION

QUESTION BANK, CLASS-XII BIOLOGY

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1	I	CHAPTER-2	4-9	SEXUAL REPRODUCTION IN FLOWERING PLANTS
2		CHAPTER-3	10-21	HUMAN REPRODUCTION
3		CHAPTER-4	22-31	REPRODUCTIVE HEALTH
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5		CHAPTER-6	41-49	MOLECULAR BASIS OF INHERITANCE
6	II	CHAPTER-8	50-54	HUMAN HEALTH AND DISEASE
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CHAPTER-2: SEXUAL REPRODUCTION IN FLOWERING PLANTS

Multiple Choice Questions

- Perisperm is-
 - Degenerate secondary nucleus
 - Peripheral part of endosperm
 - Remnant of nucleus
 - Degenerate synergids
- Which of the following fruit is a case of parthenogenesis?
 - Fruit without seeds after pollination
 - Fruit with seeds after pollination
 - Fruit with viable seeds without fertilization
 - Fruit with viable seeds after fertilization.
- If an endosperm cell of an angiosperm has 24 chromosomes, the root cell of megaspore mother cell should have-
 - 8
 - 16
 - 4
 - 24
- How many meiotic divisions are needed for forming 100 grains of wheat?
 - 100
 - 25
 - 50
 - 20
- Aleurone layer is present in
 - The peripheral part of scutellum
 - The peripheral part of coleoptile
 - Cotyledons
 - The peripheral part of endosperm.
- Which is the most logical sequence with reference to life cycle of angiosperm?
 - Pollination, fertilization, seed formation, germination
 - Germination, endosperm formation, seed dispersal, double fertilization
 - Cleavage, fertilization, grafting, fruit formation
 - Maturation, mitosis, differentiation, fertilization.
- Sporopollenin is secreted by
 - Cytoplasm of the pollen tapetum
 - Cytoplasm of the pollen mother cell
 - Cytoplasm of the endothecium
 - Cytoplasm of the endosperm

8. Which one of these tissues is not produced from the embryonic mass of a dicotyledonous seeds?
 (a) Root tip (b) Plumule (c) Hypocotyl (d) Cotyledons
9. If the flowering plant has 12 number of chromosomes in each of its meristematic cell, which of the following structures would have 6 chromosomes?
 (a) Root apex (b) Pollen and megaspore mother cells
 (c) Microspore and functional megaspores (d) Secondary nucleus within the embryo.
10. The development of helobial endosperm is
 (a) Just like that of cellular endosperm
 (b) Exactly similar to that of nuclear endosperm
 (c) Intermediate between the nuclear and cellular endosperm
 (d) None of the above.
11. Embryo sac of an angiosperm is homologous to
 (a) Megaspore (b) Female gametophyte
 (c) Sporangium (d) None of above
12. Anthesis is-
 (a) Dehiscence of anthers (b) Opening of floral bud (c) Entry of pollen tube into ovule (d) Emergence of anthers
13. Entry of pollen tube through micropyle is called
 (a) Mesogamy (b) Pseudogamy (c) Chalazogamy (d) Porogamy.
14. The outermost and innermost wall layers of microsporangium in an anther are respectively
 (a) Endothecium and tapetum (b) Epidermis and endodermis
 (c) Epidermis and middle layer (d) Epidermis and tapetum.
15. In a fertilized embryo sac, the haploid, diploid and triploid structures are-
 (a) Synergid, zygote and primary endosperm nucleus
 (b) Synergid, antipodal and polar nuclei
 (c) Antipodal, synergid and primary endosperm nucleus
 (4) Synergid, polar nuclei and zygote
16. Milky water in green coconut is
 (a) Free nuclear Liquid endosperm (b) Liquid female gametophyte
 (c) Liquid nucleus (4) Liquid chalaza
17. A plant with both male and female flowers is
 (a) Unisexual (b) Bisexual (C) Monoecious (d) Dioecious
18. Filiform apparatus occurs in
 (a) Synergids (b) Antipodals
 (c) Egg nucleus (d) Secondary nucleus.
19. A dicotyledonous plant bears flowers, but never produces fruits and seeds. The most probable cause for the above situation is
 (a) plant is dioecious and bears only pistillate flowers
 (b) plant is dioecious and bears both pistillate and staminate flowers
 (C) plant is monoecious
 (d) plant is dioecious and bears only staminate flowers
20. 256 microspores will form by the meiosis of
 (a) 512 microspore mother cells (b) 128 microspore mother cells
 C) 64 microspore mother cells (d) 48 microspore mother cells

21. If a normal plant suddenly started reproducing parthenogenetically, the number of chromosomes of the second generation compared to the parent will be
 (a) One-half (b) One fourth (c) Double (d) Same.
22. In a flower, if the megaspore mother cell forms megaspores without undergoing meiosis and if one of the megaspores develops into an embryo sac, its nuclei would be
 (a) Haploid (b) Diploid
 (c) A few haploid and a few diploid (d) With varying ploidy
23. In an embryo sac, the cells that degenerate after fertilization are:
 (a) Synergids and primary endosperm cell (b) Synergids and antipodals
 (c) Antipodals and primary endosperm cell (d) Egg and antipodals,
24. In the embryos of a typical dicot and a grass, true homologous structures are:
 (a) Coleorhiza and coleoptile (b) Coleoptile and scutellum
 (c) Cotyledons and scutellum (d) Hypocotyl and radicle
25. While planning for an artificial hybridisation programme involving dioecious plants, which of the following step would NOT be relevant:
 (a) Bagging of female flower (b) Dusting of pollen on stigma
 (c) Emasculation (d) Collection of pollen.
26. Choose the correct statement from the following
 (a) Cleistogamous flowers always exhibit autogamy
 (b) Chasmogamous flowers always exhibit geitonogamy
 (c) Cleistogamous flowers exhibit both autogamy and geitonogamy
 (d) Chasmogamous flowers never exhibit autogamy.
27. Autogamy can occur in a chasmogamous flower if
 (a) pollen matures before maturity of ovule
 (b) ovule matures before maturity of pollen
 (c) both pollen and ovules mature simultaneously
 (d) both anther and stigma are of equal lengths.
28. A particular species of plant produces light, non-sticky pollen in large numbers and its stigmas are long and feathery. These modifications facilitate pollination by
 (a) insects (b) water (c) wind (d) animals
29. From among the situations given below, choose the one that prevents both autogamy and geitonogamy
 (a) Monoecious plant bearing unisexual flowers
 (b) Dioecious plant bearing only male or female flowers
 (c) Monoecious plant with bisexual flowers
 (d) Dioecious plant with bisexual flowers.
30. Starting from the innermost part, the correct sequence of parts in an ovule is
 (a) egg nucellus, embryo sac, integument (b) egg, embryo sac, nucellus, integument
 (c) embryo sac, nucellus, integument, egg (d) egg, integument, embryo sac, nucellus

Assertion and Reasoning based Questions (Question No. 31 to 40)

In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements mark the correct answer as:

- (a) Both Assertion and Reason are true and the reason is the correct explanation of the Assertion.
 (b) Both Assertion and Reason are true and the reason is not the correct explanation of the Assertion.
 (c) Both Assertion and Reason are true and the reason is the correct explanation of the Assertion.
 (d) Both Assertion and Reason are true and the reason is the correct explanation of the Assertion.

31. Assertion. Maize is an albuminous seed.

Reason. Its endosperm is completely absorbed by its growing embryo.

32. Assertion. The megaspore mother cells divide by meiotic division to produce four spores.

Reason. Megaspore Mother Cells (MMC) are diploid and megaspores are haploid.

33. Assertion. 7-celled, 8 nucleate and monosporic embryo sac is Most common type of embryo sac in dicotyledonous plants.

Reason. It was discovered first time in plant *Polygonium*.

34. Assertion. Female gametophyte in angiosperm is eight nucleate.

Reason. Double fertilization occurs in angiosperms

35. Assertion. Parthenogenesis is an apomixis where seeds are developed from unfertilized female gamete.

Reason. Parthenogenesis always occurs by the application of chemicals.

36. Assertion. Pollen grains, in case of hydrophily, are covered by mucilaginous/oily layer.

Reason. Mucilaginous is a viscous sticky substance that protects the pollen from water.

37. Assertion. Exine of pollen grain is comprised of sporopollenin which is resistant to high temperature, strong acid or alkali.

Reason. Sporopollenin is absent in the region of germ pore.

38. Assertion. In Ophrys one petal of the flower bears an uncanny resemblance to the female bee.

Reason. Two closely related species competing for the same resource can coexist simultaneously.

39. Assertion. Majority of insect-pollinated flowers are large, colourful, fragrant and rich in nectar.

Reason. Insects are attracted to flowers by colour, fragrance and or nectar.

40. Assertion. The continued self-pollination results in inbreeding depression.

Reason. The device to prevent self-pollination is the production of bisexual flowers.

Case Based Questions

1. Read the following and answer questions given below from (i) to (v) 5

In major approaches of crop improvement programme as in crossing experiments, it is important to make sure that only the desired pollen grains are used for pollination and the stigma is protected from contamination from unwanted pollens. So, if the female parent bears bisexual flowers, removal of anthers from the flower bud before the anther dehiscence is necessary (Emasculation). Emasculated flowers have to be covered with bags of suitable size to prevent contamination of their stigma with unwanted pollen-bagging. When the stigma of bagged flower attains receptivity, mature pollen grains collected from anthers of the male parent are dusted on the stigma and the flowers are re-bagged and the fruits are allowed to develop. If the female parent produces unisexual flowers, there is no need for emasculating.

(i) While planning for an artificial hybridisation involving dioecious plants, which of the following steps would not be relevant?

(a) Bagging of female flower

(b) Dusting of pollen on stigma

(c) Emasculation

(d) Collection of pollen

(ii) Assertion- If the female parent produces unisexual flowers, there is no need of

emasculating

Reason- Emasculation is the removal of anthers from the flower bud before the anther dehiscence.

(a) Both assertion and reason are true, and reason is the correct explanation of assertion.

(b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

(iii) Artificial hybridization denotes to

(a) production of seedless fruits

(b) evolve seeds without fertilization

(c) crop improvement programme

(d) occurrence of more than one embryo in a

(iv) The correct sequence to perform artificial hybridization is

- (a) Bagging-Emasculation -) Re-bagging -) Cross pollination
- (b) Emasculation -)Bagging-)Cross pollination-) Re-bagging
- (c) Cross pollination-) Emasculation-) Bagging -)Re-bagging
- (d) Bagging-)Re-bagging-) Cross pollination-) Emasculation seed

(v) Bagging technique in artificial hybridization approach is done

- (a) To prevent contamination of stigma with unwanted pollens
- (b) After the anthers have been dehisced
- (c) Only in monoecious plants
- (d) To promote production of apomixis

2. Read the following and answer questions given below from (i) to (v)

Pollen grains are generally spherical shaped and each is surrounded by two layers - exine and intine. Exine is made up of sporopollenin which is resistant to high temperatures and strong acids and alkali. Sporopollenin remains absent at germ pores. Pollen grains are well preserved as fossils because of the presence of sporopollenin. The inner wall of pollen grain is intine. The pollen grains are mainly shed at 2-celled stage-vegetative cell and generative cell when they are matured. Pollen grains of many species cause severe allergies and bronchial affections, leading to chronic respiratory disorders. It is mentioned that *Parthenium* or carrot grass that came into India as contaminant with imported wheat, has become ubiquitous in occurrence and causes pollen allergy. However, pollen grains are rich in nutrients which are used pollen tablets as food supplements. In western countries, large number of pollen products in the form of tablets and syrups are available in the market which are claimed to increase the performance of athletes and race horses.

(i) **Assertion-** Sporopollinin is an oxidative polymer of carotenoids which helps in fossilization.

Reason- Sporopollinin is a tough substance that provides resistant to biological decomposition, high temperature and alkali.

- (a) Both assertion and reason are true, and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true, but reason is not the correct explanation of the assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

(ii) **Which of the following statements is not appropriate for pollen grains**

- (a) Pollen grains can be stored for years in liquid nitrogen and can be used in crop breeding programmes.
- (b) Pollen grains are rich in nutrients and can be used as pollen tablets as food supplements.
- (c) Bee pollen are available in western countries in the form of tablets.
- (d) Pollen consumption has potential inhibitory action which results in decreased energy in athletes and race horses.

(iii) **Pollen allergy is common in many people during spring, summer and fall as plants release tiny pollen grains in tremendous quantity. Which of the following is not associated with pollen allergy?**

- (a) Sneezing stuffy nose and watery, eyes
- (b) Asthma, bronchitis
- (c) Cough, itchy nose, roof of mouth or throat
- (d) Fever, diarrhoea and vomiting

(iv) **Which of the following set does not cause allergy?**

- (a) *Ragweed parthenium*
- (b) Sagebrush
- (c) *Amaranthes* (pigweed)
- (d) *Acacia*.

(v) **The function of germ pore in pollen grain is**

- (a) Emergence of radicle
- (b) Absorption of water for seed germination
- (c) Initiation of pollen tube
- (d) All of these

3. Read the following and answer questions given below from (i) to (V)

A flower of tomato plant following the process of sexual reproduction produces 240 viable seeds. The viable seeds are those which have the ability to remain alive and may develop into plants and reproduce themselves in the given appropriate conditions. This happens when one of the pollen grain

reaches to the stigma by any agency at 2-celled stage vegetative cell and generative cell. The generative cell divides mitotically and forms two male gametes which enters into ovule after passing through pollen tube and undergoes the process of double fertilization in the ovule. The ovule is a large parenchymatous body formed in the ovary by megasporogenesis. The megaspore mother cell in an ovule diploid structure which undergoes meiotic division and forms one functional megaspore. The megaspore undergoes three subsequent divisions and forms 8 nuclei arranging themselves in 3 groups. After fertilization, the ovule converts into the seed and whole ovary develops into a complete fruit.

- i) The minimum number of pollen grains that must have been involved in the pollination of its pistil are.....
- (a) 60 (b) 120 (c) 180 (d) 240
- (i) The minimum number of microspore mother cells must have undergone reductional division prior to dehiscence of anther are:
- (a) 60 (b) 90 (c) 180 (d) 240
- (iii) The male gametes that might have involved in this case are:
- (a) 120 (b) 240 (c) 360 (d) 480
- (iv) The minimal number of ovules present in the ovary would be: (a) 60 (b) 120 (c) 180 (d) 240
- (v) Megaspore mother cells involved in this process are
- (a) 120 (b) 180 (c) 240 (d) 360

Chapter -2 Answer MCQs

1-b	2-a	3-b	4-a	5-d	6-a	7-c	8-d	9-c	10-c
11-b	12-b	13-d	14-d	15-a	16-a	17-c	18-a	19-d	20-c
21-d	22-b	23-b	24-c	25-c	26-a	27-c	28-c	29-b	30-b
Answer Assertion and Reasoning based Questions									
31-c	32-d	33-c	34-b	35-c	36-a	37-b	38-c	39-a	40-c
Answer Case Based Questions									
1	i-c	ii-b	iii-c	iv-b	v-a				
2	i-a	ii-d	iii-d	iv-d	v-c				
3	i-d	ii-a	iii-d	iv-d	v-c				

CHAPTER-3: HUMAN REPRODUCTION

MCQ

Question 1. Ovulation in the human female normally takes place during the menstrual cycle

- (a) at the mid secretory phase
- (b) just before the end of the secretory phase
- (c) at the beginning of the proliferative phase
- (d) at the end of the proliferative phase.

Question 2. After ovulation Graafian follicle regresses into

- (a) corpus atresia
- (b) corpus callosum
- (c) corpus luteum
- (d) corpus albicans

Question 3. Immediately after ovulation, the mammalian egg is covered by a membrane known as

- (a) chorion
- (b) zona pellucida
- (c) corona radiata
- (d) vitelline membrane.

Question 4. Which one of the following events is correctly matched with the time period in a normal menstrual cycle ?

- (a) Release of egg : 5 th day
- (b) Endometrium regenerates : 5 – 10 days
- (c) Endometrium secretes nutrients for implantation: 11 – 18 days
- (d) Rise in progesterone level : 1 – 15 days

Question 5. If mammalian ovum fails to get fertilised, which one of the following is unlikely ?

- (a) Corpus luteum will disintegrate.
- (b) Progesterone secretion rapidly declines.
- (c) Estrogen secretion increases.
- (d) Primary follicle starts developing

Question 6. A human female reaches menopause around the age of

- (a) 50 years
- (b) 15 years
- (c) 70 years
- (d) 25 years.

Question 7. A reaction of granules content which harden the zona pellucida and ensures sure block to polyspermy is

- (a) acrosomal reaction
- (b) cortical reaction
- (c) acrosin reaction
- (d) bindin reaction.

Question 8. Which part of the sperm plays an important role in penetrating the egg membrane?

- (a) Allosome
- (b) Tail
- (c) Autosome
- (d) Acrosome

Question 9. In oocyte secondary maturation occurs in

- (a) ovary
- (b) abdominal cavity
- (c) Fallopian tube
- (d) uterus

Question 10. Besides activating the egg another role of a sperm is to carry to egg

- (a) RNA
- (b) mitochondria
- (c) DNA
- (d) ribosome:

Question 11. Preparation of sperm before penetration of ovum is

- (a) spermiation
- (b) cortical reaction
- (c) spermiogenesis
- (d) capacitation.

Question 12 Spermiation is the process of the release of sperms from

- (a) seminiferous
- (b) vas deferens
- (c) epididymis
- (d) prostate gland

Question 13. Mature Graafian follicle is generally present in the ovary of a healthy human female around

- (a) 5-8 day of menstrual cycle
- (b) 11-17 day of menstrual cycle
- (c) 18-23 day of menstrual cycle
- (d) 24-28 day of menstrual cycle.

Question 14. Acrosomal reaction of the sperm occurs due to

- (a) its contact with zona pellucida of the ova
- (b) reactions within the uterine environment of the female
- (c) reactions within the epididymal environment of the male

(d) androgens produced in the uterus.

Question 15. Which one of the following is not a male accessory gland ?

- (a) Seminal vesicle (b) Ampulla (c) Prostate (d) Bulbourethral gland

Question 16. Which among the following has 23 chromosomes ?

- (a) Spermatogonia (b) Zygote (c) Secondary oocyte (d) Oogonia

Question 17. Which of the following hormones is not secreted by human placenta ?

- a) hCG (b) Estrogens (c) Progesterone (d) LH

Question 18. The vas deferens receives duct from the seminal vesicle and opens into urethra as

- (a) epididymis (b) ejaculatory duct (c) efferent ductile (d) ureter

Question 19. Urethral meatus refers to the-

- (a) urinogenital duct (b) opening of vas deferens into urethra
(c) external opening of the urinogenital duct (d) muscles surrounding the urinogenital duct.

Question 20. Morula is a developmental stage

- (a) between the zygote and blastocyst (b) between the blastocyst and gastrula
(c) after the implantation (d) between implantation and parturition.

Question 21. The membranous cover of the ovum at ovulation is

- (a) corona radiata (b) zona radiata (c) zona pellucida (d) chorion.

Question 22. Identify the odd one from the following

- (a) Labia minora (b) Fimbriae (c) Infundibulum (d) Isthmus

Question 23. Temperature of the scrotum which is necessary for the functioning of testis is always _____ around below body temperature.

- (a) 2°C (b) 4°C (c) 6°C (d) 8°C

Question 24. Which of the following is correct about mammalian testes?

- (a) Graafian follicles, Sertoli cells, Leydig's cells
(b) Graafian follicles, Sertoli cells, Seminiferous tubules
(c) Sertoli cells, Seminiferous tubules, Leyding's cells
(d) Graafian follicle, leyding's cells, Seminiferous tubule

Question 25. The nutritive cells found in seminiferous tubules are

- (a) Leydig's cells (b) atretic follicular cells (c) Sertoli cells (d) chromaffin cells.

Question 26. Sertoli cells are regulated by the pituitary hormone known as

- (a) LH (b) FSH (c) GH (d) prolactin.

Question 27. The head of the epididymis at the head of the testis is called

- (a) cauda epididymis (b) vas deferens (c) caput epididymis (d) gubernaculum.

Question 28. Seminal plasma in humans is rich in

- (a) fructose and calcium but has no enzymes (b) glucose and certain enzymes but has no calcium
(c) fructose and certain enzymes but poor in calcium (d) fructose, calcium and certain enzymes.

Question 29. Prostate glands are located below

- (a) gubernaculum (b) seminal vesicles (c) epididymis (d) bulbourethral glands

Question 30. The function of the secretion of prostate gland is to

- (a) inhibit sperm activity (b) attract sperms (c) stimulate sperm activity (d) none of these.

Question 31. Lower narrow end of uterus is called

- (a) urethra (b) cervix (c) clitoris (d) vulva.

Question 32. Bartholin's glands are situated

- (a) on the either side of vagina in humans (b) on either side of vas deferens in humans
(c) on either side of penis in humans (d) on either side of Fallopian tube in humans.

Question 33. In human adult females oxytocin

- (a) stimulates pituitary to secrete vasopressin (b) causes strong uterine contractions during parturition
(c) is secreted by anterior pituitary (d) stimulates growth of mammary gland

Question 34. The third stage of parturition is called –after-birth|. In this stage

- (a) excessive bleeding occurs
(b) fetus is born and cervix and vagina contraction to normal condition happens
(c) fetus is born and contraction of uterine wall prevents excessive bleeding
(d) placenta is expelled out.

Question 35. After birth, colostrum is released from mammary glands which is rich in

- (a) fat and low in proteins (b) proteins and low in fat
(c) proteins, antibodies and low in fat (d) proteins, fat and low in antibodies.

Question 36. Spot the odd one out from the following structures with reference to the male reproductive system.

- (a) Rate testis (b) Epididymis (c) Vasa efferentia (d) Isthmus

Question 37. Seminal plasma, the fluid part of semen, is contributed by

- (i) seminal vesicle (ii) prostate (iii) urethra (iv) bulbourethral gland

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

Question 38. In humans, at the end of the first meiotic division, the male germ cells differentiate into the

- (a) spermatids (b) spermatogonia (c) primary spermatocytes (d) secondary spermatocytes

Question 39. How many sperms are formed from a secondary spermatocyte? (a) 4 (b) 8 (c) 2 (d) 1

Question 40. How many sperms are formed from 4 primary spermatocytes? (a) 4 (b) 1 (c) 16 (d) 32

Question 41. In spermatogenesis, reduction division of chromosome occurs during conversion of

- (a) spermatogonia to primary spermatocytes
(b) primary spermatocytes to secondary spermatocytes
(c) secondary spermatocytes to spermatids
(d) spermatids to sperms

Question 42. Which of the following groups of cells in the male gonad, represent haploid cells?

- (a) Spermatogonial cells (b) Germinal epithelial cells
(c) Secondary spermatocytes (d) Primary spermatocytes

Question 43. The process of release of spermatozoa from Sertoli cells into cavity of the seminiferous tubules is called

- (a) spermiogenesis (b) spermatogenesis (c) spermatocytogenesis (d) spermiation.

Question 44. The principal tail piece of human sperm shows the microtubular arrangement of (a) 7+2 (b) 9+2 (c) 11+2 (d) 13+2

Question 45. Acrosome is a type of

- (a) lysosome (b) flagellum (c) ribosome (d) basal body.

Question 46. Which of the following contains the actual genetic part of a sperm ?

- (a) Whole of it (b) Tail (c) Middle piece (d) Head

Question 47. The sperms undergo physiological maturation, acquiring increased motility and fertilizing capacity in

- (a) seminiferous tubules (b) vasa efferentia (c) epididymis (d) vagina.

Question 48. At what stage of life is oogenesis initiated in a human female ?

- (a) At puberty (b) During menarche (c) During menopause (d) During embryonic development

Question 49. 1st polar body is formed at which stage of oogenesis ?

- (a) 1st meiosis (b) 2nd mitosis (c) 1st mitosis (d) Differentiation

Question 50. Which one is released from the ovary ?

- (a) Primary oocyte (b) Secondary oocyte (c) Graafian follicle (d) Oogonium

Question 51. During oogenesis, each diploid cell produces

- (a) four functional eggs (b) two functional eggs and two polar bodies
(c) one functional egg and three polar bodies (d) four functional polar bodies

Question 52. In oogenesis haploid egg is fertilised by sperm at which stage ?

- (a) Primary oocyte (b) Secondary oocyte (c) Oogonium (d) Ovum

Question 53. Layers of an ovum from outside to inside is

- (a) corona radiata, zona pellucida and vitelline membrane
(b) zona pellucida, corona radiata and vitelline membrane
(c) vitelline membrane, zona pellucida and corona radiata
(d) zona pellucida, vitelline membrane and corona radiata.

Question 54. Which part of ovary in mammals acts as an endocrine gland after ovulation ?

- (a) Stroma (b) Germinal epithelium (c) Vitelline membrane (d) Graafian follicle

Question 55. The sex of the fetus will be decided at

- (a) fertilisation by male gamete (b) implantation
(c) fertilisation by female gamete (d) the start of cleavage.

Question 56. What is true about cleavage in the fertilised egg in humans ?

- (a) It starts while the egg is in Fallopian tube. (b) It starts when the egg reaches uterus.
(c) It is meroblastic (d) It is identical to the normal mitosis.

Question 57. Cleavage differs from mitosis in lacking

- (a) synthetic phase (b) growth phase (c) both (a) and (b) (d) none of these.

Question 58. The solid mass of 8-16 cells formed from zygote after successive mitotic divisions is called

- (a) blastula (b) gastrula (c) morula (d) none of these.

Question 59. Implantation takes place after _____ of fertilisation.

- (a) 5 days (b) 6 days (c) 7 days (d) 8 days

Question 60. Structure connecting the fetus to placenta is

- (a) umbilical cord (b) amnion (c) yolk sac (d) chorion.

Question 61. Which of the following hormones is not a secretory product of human placenta?

- (a) Human chorionic gonadotropin (b) Prolactin (c) Estrogen (d) Progesterone

Question 62. Urine test during pregnancy determines the presence of

- (a) human chorionic gonadotropin hormone (b) estrogen
(c) progesterone (d) luteinising hormone.

Question 63. In the event of pregnancy, the corpus luteum persists under the influence of

- (a) LH (b) FSH (c) chorionic gonadotropin (d) progesterone.

Question 64. During the development of embryo, which of the following occurs first?

- (a) Differentiation of organ (b) Differentiation of tissue
(c) Differentiation of organ system (d) Differentiation of cells

Question 65. The structures derived from ectoderm are

- (i) pituitary gland (ii) cornea (iii) kidneys (iv) notochord
(a) (i) and (iii) (b) (ii) and (iii) (c) (i) and (ii) (d) (ii) and (iv).

Question 66. Gastrula is the embryonic stage in which

- (a) cleavage occurs (b) blastocoel form (c) germinal layers form (d) villi form.

Question 67. In the development of the human body, the ectoderm is responsible for the formation of

- (a) lens of the eye (b) nervous system (c) sweat glands (d) all of these.

Question 68. The first movements of the fetus and appearance of hair on its head are usually observed during which month of pregnancy?

- (a) Fourth month (b) Fifth month (c) Sixth month (d) Third month

Question 69. The early stage human embryo distinctly possesses

- (a) gills (b) gill slits (c) external ear (pinna) (d) eyebrows.

Question 70. Delivery of developed fetus is scientifically called

- (a) parturition (b) oviposition (c) abortion (d) ovulation.

ANSWERS

QUESTIONS	ANSWERS	QUESTIONS	ANSWERS	QUESTIONS	ANSWERS
1	D	24	C	47	C
2	C	25	C	48	D
3	C	26	B	49	A
4	B	27	C	50	B
5	C	28	D	51	C
6	A	29	B	52	B
7	B	30	C	53	A
8	D	31	B	54	D
9	C	32	A	55	A
10	C	33	B	56	A
11	A	34	D	57	B
12	A	35	C	58	C
13	B	36	D	59	C
14	A	37	B	60	A
15	B	38	D	61	B
16	C	39	C	62	A
17	D	40	C	63	C
18	B	41	B	64	D
19	C	42	C	65	C
20	A	43	D	66	C
21	A	44	C	67	D
22	A	45	A	68	B
23	A	46	D	69	B
				70	A

CHAPTER 3 BIOLOGY (Assertion Reason)

Directions:

In the following questions, a statement of assertion is followed by a statement of reason. Mark the correct choice as:

- (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- (c) If Assertion is true but Reason is false.
- (d) If both Assertion and Reason are false

1. **Assertion:** In human male, testes are extraabdominal and lie in scrotal sacs

Reason: Scrotum acts as thermoregulator and keeps testicular temperature lower by 2°C for normal spermatogenesis

2. **Assertion:** Testicular lobules are the compartments present in testes.

Reason: These lobules are involved in the process of fertilization.

3. **Assertion:** Interstitial cell is present in the region outside the seminiferous tubule called interstitial spaces

Reason: Interstitial cells provide nutrition to the Sertoli cells.

4. **Assertion:** The testes are situated outside the abdominal cavity within the scrotum.

Reason: Muscles in scrotum help to maintain low temperature of testes, necessary for spermatogenesis

5. **Assertion:** The bulbourethral gland is a male accessory gland.

Reason: Its secretion helps in the lubrication of the penis, thereby facilitating reproduction.

6. **Assertion:** Each seminiferous tubule is lined on its inside by three types of cells.

Reason: These cells are male germ cells, Sertoli cells and Leydig cells.

7. **Assertion:** In human male, there are perianal glands near the anus

Reason: Perianal glands secrete sex-attractant pheromone which initiates sexual desire in human.

8. **Assertion:** Testes are located in the scrotum, outside the coelom.

Reason: A vaginal coelom partly surrounds the testes in the scrotum.

9. **Assertion:** Fimbriae are finger-like projections of the infundibulum part of oviduct which is closest to ovary.

Reason: They are important for collection of ovum after ovulation from ovary.

10. **Assertion:** Finger-like projections appear on the trophoblast called chorionic villi after implantation.

Reason: Chorionic villi are surrounded by the uterine tissue and maternal blood.

11. **Assertion:** Infundibulum is a funnel shaped part closer to ovary.

Reason: The edges of infundibulum help in collection of the ovum after ovulation.

12. **Assertion:** The female external genitalia includes mons pubis, labia majora and labia minora

Reason: The glandular tissue of each breast is divided into 5-10 mammary lobes.

13. **Assertion:** Vagina acts as copulation canal and fertilization canal

Reason: Both insemination and fusion of gametes occur in the vagina of female.

14. **Assertion:** In the testis, spermatogenesis occurs in the seminiferous tubules and testosterone secretion takes place from the Sertoli cells.

Reason: Testosterone brings growth and maturation of primary sex organs and also development of accessory sex characters

15. Assertion: Spermatogenesis starts at the age of puberty.

Reason: There is a significant increase in level of gonadotropin releasing hormone at puberty.

16. Assertion: Human male ejaculates about 200 to 300 million sperms during coitus

Reason: Only few reach the isthmus ampullary junction for process of fertilisation.

17. Assertion: The sperm head contains a cap-like structure called acrosome.

Reason: Acrosome is filled with enzymes that help in fertilisation of the ovum.

18. Assertion: A drop in temperature does not affect spermatogenesis

Reason: During temperature drop, the smooth muscles contract and bring the testes closer to the pelvic cavity.

19. Assertion: The human male ejaculates about 50-100 million sperms during a coitus.

Reason: For normal shape and size.

20. Assertion: The type B spermatogonia undergo mitosis to form primary spermatocyte. **Reason:** Primary spermatocyte completes the first meiotic division leading to secondary spermatocytes

21. Assertion: The middle piece is called as power house of the sperm.

Reason: The numerous mitochondria coiling around axial filament produce energy for the movement of the tail.

22. Assertion: The regions outside the seminiferous tubules are called interstitial spaces, which contain Leydig cell.

Reason: Leydig cells synthesise and secrete testicular hormones called androgens.

23. Assertion: Primary spermatocytes of testes are haploid.

Reason: These are formed by meiosis-I in the spermatogonia

24. Assertion: Stem cells possess the property of totipotency.

Reason: These cells can give rise to any type of cells.

25. Assertion: At puberty, human male develops secondary sexual characters.

Reason: At puberty, there is decreased secretion of testosterone in male

26. Assertion: Head of sperm consists of acrosome and mitochondria.

Reason: Acrosome contains spiral row of mitochondria.

27. Assertion: In a Graafian follicle, the primary oocyte and the follicular cells may be regarded as sibling cells.

Reason: Both arise from the same parent cell the oogonium by mitotic division.

28. Assertion: The shape of the uterus is like an inverted pear

Reason: The inner glandular layer that lines the uterine cavity is called as myometrium.

29. Assertion: Fallopian funnel of oviduct has finger-like fimbriae.

Reason: Graafian follicle of ovary is with secondary oocyte hanging in cavity called antrum.

30. Assertion: Production of FSH increases, while that of LH decreases in the ovulation phase. **Reason:**

Due to decrease in the level of LH, ovulation (releasing of ova) takes place.

31. Assertion: Graafian follicle ruptures at the mid of menstrual cycle releasing the ovum. **Reason:** Both LH and FSH attain a peak level at the middle of cycle.

32. Assertion: Progesterone is required for maintenance of the endometrium.

Reason: Endometrium is essential for implantation of embryo.

- 33. Assertion:** The endometrium undergoes cyclical changes during menstrual cycle.
Reason: The myometrium exhibits strong contractions during delivery of the baby.
- 34. Assertion:** Menstrual phase is also called shedding tears of lost ovum.
Reason: In the menstrual phase, cast of endometrial lining along with ovum takes place due to reduced titre of oestrogen and progesterone.
- 35. Assertion :** Penetration of sperm into ovum is a chemical process.
Reason : Acrosome of sperm secretes a lytic enzyme hyaluronidase which dissolves vitelline membrane of ovum.
- 36. Assertion:** Size of breasts increases at puberty in human female.
Reason: Prolactin secretion starts at puberty.
- 37. Assertion:** During fertilization only head of spermatozoa enters egg.
Reason: If several spermatozoa hit the egg at same time, all can enter the egg.
- 38. Assertion:** Corpus luteum degenerates in the absence of fertilization.
Reason: Progesterone level decreases.
- 39. Assertion:** Mammalian ova produces hyaluronidase.
Reason: The eggs of mammal are microlecithal and teleolecithal.
- 40. Assertion:** Ovum retains most of the contents of the primary oocyte and is much larger than a spermatozoa.
Reason: Ovum requires energy to go about in search of a spermatozoa for fertilisation.
- 41. Assertion:** Not all copulation leads to pregnancy.
Reason: Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary isthmic junction.
- 42. Assertion:** Implantation is the process of attachment of blastocyst on uterine endometrium.
Reason: Implantation is controlled by trophoblast and occurs by decidual cell reaction.
- 43. Assertion:** Placenta is an endocrine gland.
Reason: It secretes many hormones essential for pregnancy.
- 44. Assertion:** A woman passes out hCG in the urine during pregnancy.
Reason: The presence of hCG in urine is the basis for pregnancy test.
- 45. Assertion:** Breast feeding during initial period of infant growth is recommended.
Reason: Colostrum contains several antibodies, essential to render immunity in newborns.
- 46. Assertion:** During pregnancy, the levels of hormones like estrogens and progesterone are increased.
Reason: The increased production of these hormones is essential for foetal growth.
- 47. Assertion:** Vigorous contraction of the uterus at the end of pregnancy causes expulsion.
Reason: The stimulatory reflex between the uterine contraction and oxytocin results in weakening contractions.
- 48. Assertion:** There is generally monospermy in most of animals.
Reason: Vitelline membrane of ovum checks polyspermy.
- 49. Assertion:** All Metatherian are placental mammals.
Reason: All placental mammals have menstrual cycle.

50. Assertion: Placenta in addition to connection with mother and foetus, is a ductless gland. **Reason:** It releases human gonadotropins

51. Assertion: Embryonic development proves inter-relationship and common ancestry of metazoans

Reason: It involves similar sequence of five dynamic processes during development

52. Assertion: In morula stage, cells divide without increase in size.

Reason : Zona pellucida remains undivided till cleavage is complete.

53. Assertion: The embryo with 8 to 16 blastomeres is called a morula.

Reason: The morula continues to divide and transforms into trophoblast.

54. Assertion: Parturition is induced by neural signal in maternal pituitary.

Reason: At the end of gestation period, the maternal pituitary releases prolactin which causes uterine contractions.

SOLUTION

- (a) In human male, one pair testes are present in thin walled skin pouches called scrotal sac (so are extraabdominal) hanging from lower abdominal wall between the legs. Scrotal sac act as thermoregulators and keeps the testicular temperature 2°C lower than body temperature for normal spermatogenesis, as high abdominal temperature kills the spermatogenic tissue.
- (d) Testicular lobules are the compartments present in the testes that are not involved in the process of fertilization as whole. Fusion of male and female gametes is called fertilization.
- (c) Leydig cells, also known as interstitial cells, are found adjacent to the seminiferous tubules in the testicle. They produce testosterone in the presence of luteinizing hormone (LH).
- (a) The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining low temperature of the testes (2-2.5 °C) lower than the normal internal body temperature which is necessary for spermatogenesis.
- (a) Bulbourethral gland, also called Cowper's Gland, either of two pea-shaped glands in the male are located beneath the prostate gland at the beginning of the internal portion of the penis. These are responsible for adding fluids to semen during the process of ejaculation, thereby facilitating the process of reproduction.
- (d) Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and sertoli cells. The male germ cells undergo meiotic divisions finally leading to sperm formation, while sertoli cells provide nutrition to the germ cells. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Leydig cells synthesise and secrete testicular hormones called androgens.
- (d) Perianal gland are found in rabbit not in human beings. These are a pair of dark elongated scent glands lying behind the cowper's glands. These are sex attractant secreting glands, its smell serves as sex attractant for the female.
- (c) Vaginal coelom partly surrounds the testes in scrotum in a wrong statement because vagina is the part of external genitalia (vulva) in the female reproductive system and scrotum is a sac like structure in which testes are suspended.
- (b) The ends of the fallopian tubes close to the ovaries are covered with finger like projections called fimbriae. Each of these fimbriae are covered with tiny hair like projections called cilia. When an egg cell is released from the ovary, it is swept into the fallopian tube by the cilia of the fimbriae.
- (b) After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta.
- (b) In human females, each fallopian tube extends from the periphery of each ovary to the uterus, the part closer to the ovary is the funnel shaped infundibulum. The edges of the infundibulum possess finger-like projections called fimbriae which help in collection of the ovum after ovulation.
- (c) The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris. Mons pubis is a cushion of fatty tissue covered by skin and pubic hair. The labia majora are fleshy patches of

tissue, which extend down the mons pubis and surrounds the vaginal opening. The labia minora are paired folds of tissue under the labia majora. A functional mammary gland is characteristic of all female mammals. The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat. The glandular tissue of each breast is divided into 15-20 mammary lobes containing clusters of cells called alveoli.

13. (d) Vagina is the tubular female copulatory organ. Passageway for menstrual flow as well as birth canal. Vagina receives semen from male during mating but fertilization (fusion of gametes) occurs in fallopian tube.
14. (d) In the testis, spermatogenesis occurs in the seminiferous tubules and testosterone secretion takes place in the interstitial cells. Testosterone brings growth and maturation of secondary sex organs. It also brings about development of secondary sex characters.
15. (a) Spermatogenesis starts at the age of puberty due to significant increase in the Gonadotropin Releasing Hormone (GnRH).
16. (a) The male releases large number of sperms inside female reproductive tract to increase chances of fertilisation.
17. (b) Acrosome contains enzymes that help the sperm penetrate the ova during the fertilisation process.
18. (a) The normal temperature of the testes in the scrotum is about 2-2.5 °C lower than the internal body temperature. When the body is chilled, the smooth muscle contracts and brings the testes closer to the pelvic cavity. This movement towards the pelvic cavity allows the testes to absorb heat from the rest of the body so that the sperm cells do not become chilled and get optimum temperature for spermatogenesis.
19. (d) The human male ejaculates about 200 to 300 million sperms during a coitus out of which, at least 60 percent sperms must have normal shape and size and at least 40 percent of them must show vigorous motility for normal fertility.
20. (b) Type B spermatogonia undergo mitosis to produce diploid intermediate cells called primary spermatocytes. These cells further undergo first meiotic or reductional division to give rise to haploid secondary spermatocytes.
21. (a) The middle piece of human sperm contains mitochondria coiled round the axial filament called mitochondrial spiral. They provide energy for the movement of the sperm. So it is called as the 'powerhouse of the sperm'.
22. (b) Each testicular lobule contains one to three highly coiled seminiferous tubules in which sperms are produced. Each seminiferous tubule is lined on its inside by two types of cells called male germ cells (spermatogonia) and Sertoli cells. The male germ cells undergo meiotic divisions finally leading to sperm formation, while Sertoli cells provide nutrition to the germ cells. The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. These cells synthesise and secrete testicular hormones called androgens.
23. (d) Primary spermatocytes of testes are diploid and formed by mitotic division in the spermatogonium.
24. (a) Stem cells have the property to give rise to any type of cell/tissue.
25. (c) Puberty in human male is controlled by male sex hormone testosterone which is secreted by interstitial or Leydig cells of testes. So, secondary sexual characters develop and at puberty, secretion of testosterone is increased.
26. (c) Head of a sperm has acrosome but the spiral row of mitochondria are present in the mid (connecting) piece of the sperm.
27. (a) Primary oocyte and follicle cells both arise from the Graafian follicle by mitosis cell division. Hence, these are regarded as the sibling cells.
28. (c) The uterus is single and it is also called womb. The shape of the uterus is like an inverted pear. The wall of the uterus has three layers, external thin membranous perimetrium, middle thick layer of smooth myometrium and inner glandular layer of endometrium.
29. (b) Infundibulum is funnel shaped end of fallopian or oviduct. The funnel is called oviducal funnel or fallopian funnel. Its free end bears a number of finger like processes called fimbriae, but Graafian follicle of ovary is with secondary oocyte hanging in cavity, called antrum.
30. (c) In fertility phase/ovulation, production of FSH decrease, while that of LH increases. It causes ovulation. The ovum is drawn into fallopian tube. It is viable for two days when fertilisation can occur. Ovulation takes place between 10th-14th day. Two characteristics of the fertility phase that help in fertilisation are : (i) Uterine movement help in the spread of sperms in female reproductive tract. (ii) Ciliary movements in the epithelium of fallopian tubes for bringing in the ovum.

31. (a) Graafian follicle is formed due to increase in FSH and ruptures due to rise in level of LH during middle of menstrual cycle
32. (b) Progesterone prepares the uterus for pregnancy. After ovulation occurs, the ovaries start to produce progesterone needed by the uterus. Progesterone causes the uterine lining or endometrium to thicken. This helps to prepare a supportive environment in the uterus for a fertilized egg
33. (b) The wall of the uterus has three layers of tissue. The external thin membranous perimetrium, middle thick layer of smooth muscle, myometrium and inner glandular layer called endometrium that lines the uterine cavity. The endometrium undergoes cyclical changes during menstrual cycle while the myometrium exhibits strong contraction during the delivery of the baby.
34. (a) Menstrual phase is the phase of menstrual flow which continues for 3-5 days and involves discharge of blood along with casting off endometrial lining due to reduced titre of both estrogen and progesterone. Menstrual phase is also called funeral of unfertilized egg or shedding tears of lost ovum. First day of menstrual phase is also considered to be first day of menstrual cycle.
35. (a) Penetration of sperm is a chemical mechanism. In this, acrosome of sperm undergoes acrosomal reaction and releases certain sperm lysins, which dissolve the egg locally and make the path for the penetration of sperm lysins which are acidic proteins. These sperm lysins contain a lysing enzyme hyaluronidase which dissolves the hyaluronic acid polymers in the intercellular spaces which holds the granulosa cells of corona radiata together; corona penetrating enzyme and acrosin. Then it dissolves the zona pellucida. Only sperm nucleus and middle piece enters the ovum.
36. (b) In female, breasts size increases after puberty under the stimulation of estrogen. Size of breasts is further increased during pregnancy and after childbirth under the stimulation of prolactin hormone.
37. (c) During fertilization, only one sperm head enters into ovum and remaining parts of body degenerates. If several spermatozoa hit the egg at same time, even then only one can get entry into egg because after entry of one sperm, the egg becomes impervious to other sperms
38. (b) In female, graafian follicle forms corpus luteum after ovulation. The cells of corpus luteum are called luteal cells. The cytoplasm of luteal cells have yellow granules called lutein which secrete the hormone progesterone to maintain pregnancy if fertilization takes place. In the absence of fertilization, corpus luteum degenerates and forms corpus albicans and there is decrease in progesterone level as well.
39. (d) Hyaluronidase, a hydrolytic enzyme is an acrosomal content in mammalian sperm. It helps at the time of fertilization during the penetration of the sperm into the ovum. Based on the amount of yolk, mammalian eggs are alecithal means egg without yolk. Microlecithal eggs contain very little yolk e.g., sea urchin, starfish. On the basis of distribution of yolk, teleolecithal eggs are those eggs in which the yolk, is concentrated towards the vegetal pole and cytoplasm and nucleus lie near the animal pole e.g., birds and reptiles.
40. (c) Sperm needs energy to move about in female tract, so that fertilisation of ova takes place.
41. (a) All copulation do not lead to fertilisation as the synchronisation of sperm and ova reaching the fallopian tube is important.
42. (b) The process of attachment of the blastocyst (mammalian blastula) on the endometrium of uterus is called implantation.
43. (b) Placenta is an endocrine gland that is present only during pregnancy. It is responsible for production of various hormones like human Chorionic Gonadotropin (hCG), estrogen, progesterone, human placental lactogen (hPL).
44. (b) The chorionic cells secrete a hormone called human Chorionic Gonadotropin (hCG), which resembles and takes over the job of pituitary LH during pregnancy. hCG maintains the corpus luteum and stimulates it to secrete progesterone.
45. (a) Colostrum is rich in antibodies, which is essential for new born babies
46. (b) During pregnancy, the levels of hormones like estrogen, progesterone, cortisol, prolactin, thyroxine, etc., are increased several folds in the maternal blood. Increased production of these hormones is essential for supporting the foetal growth, metabolic changes in the mother and maintenance of pregnancy.
47. (c) Vigorous contraction of the uterus at the end of pregnancy causes parturition. Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex.
48. (b) Entrance of a single sperm into an oocyte is called monospermy generally found in most of animals. Cortical granules are extruded in the perivitelline space by exocytosis and some of these are attached along inner surface of vitelline membrane which now thickens and becomes impervious to any other sperm entry. It is now called fertilization membrane. It prevents polyspermy.

49. (b) Metatherians are pouched mammals or marsupials; whereas eutherians are placental mammals with well developed placenta
50. (a) Placenta is a ductless endocrine gland which produces various hormones like human Chorionic Gonadotropin (hCG), estrogen, progesterone, human placental lactogen (hPL).
51. (a) Embryonic development includes a definite series of phases which are fundamentally similar in all sexually reproducing organisms, and transform a one-celled zygote to a multicellular and fully formed developmental stage till hatching or birth. Such a remarkable similarity of embryonic development proves that all metazoans are interrelated and have common ancestry. Embryonic development involves five dynamic changes and identifiable processes which are - gametogenesis, fertilization, cleavage, gastrulation and organogenesis
52. (a) Morula involves cleavage of cells till 32 cell stage is formed. It is still surrounded by zona pellucida.
53. (c) Cleavage starts as the zygote moves through the isthmus of the oviduct towards the uterus and forms 2, 4, 8, 16 daughter cells called blastomeres. The embryo with 8 to 16 blastomeres is called a morula. The morula continues to divide and transforms into blastocyst as it moves further into the uterus.
54. (d) The process of delivery of foetus (childbirth) is called parturition. Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induces mild uterine contractions called foetal ejection reflex. This triggers release of oxytocin from the maternal pituitary. Oxytocin acts on the uterine muscles and causes stronger uterine contractions which in turn stimulate further secretion of oxytocin. The stimulatory reflex between the uterine contractions and oxytocin secretion continues resulting in stronger and stronger contractions. This leads to expulsion of the baby out of the uterus through the birth canal.

CASE STUDY BASED QUESTION

The average duration of human pregnancy is about 9 months which is called the gestation period. Vigorous contraction of the uterus at the end of pregnancy causes expulsion / delivery of the foetus. This process of delivery of the foetus (childbirth) is called parturition. Parturition is induced by a complex neuroendocrine mechanism. The signals for parturition originate from the fully developed foetus and the placenta which induce mild uterine contractions called foetal ejection reflex. This triggers the release of oxytocin hormone from the maternal pituitary gland. Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin. The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions. This leads to expulsion of the baby out of the uterus through the birth canal — parturition. Soon after the infant is delivered, the placenta is also expelled out of the uterus.

- i. The birth of a baby is known as
 - a. Micturition
 - b. Parturition
 - c. Child
 - d. Oxytocin
- ii. When a fully developed baby is not naturally delivered by the mother, it could be due to the -
 - a. Non-secretion of Oxytocin
 - b. Excess secretion of Oxytocin
 - c. Wide birth canal
 - d. None of the above.
- iii. Soon after the infant is delivered, the placenta is also expelled out of the uterus, because
 - a. The infant requires the placenta to be alive
 - b. After the birth, there is no role for the placenta
 - c. Placenta is a part of the infant
 - d. None of the above
- iv. Oxytocin is known as the child birth hormone as well as the:
 - a. Urine regulating hormone
 - b. Milk ejection hormone
 - c. Milk producing hormone
 - d. None of the above
- v. **Assertion:** Release of oxytocin is essential for the child birth after the complete development of the foetus.

Reason: Premature release of Oxytocin leads to the birth of a pre-mature baby.

Answers: 7 .i. b. ii. a. iii. b. iv. b. v. b.

CHAPTER-4 REPRODUCTIVE HEALTH

ASSERTION REASONING QUESTIONS

These questions consist of two statements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses.

- A) *Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.*
- B) *Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.*
- C) *Assertion is true but the Reason is false.*
- D) *Both Assertion and Reason are false*

1. **Assertion:** Use of condom is a safeguard against AIDS and sexual diseases besides checking pregnancy.
Reason: Condoms are physical barriers preventing body fluid of two partners to come in contact.
2. **Assertion:** Copper-T is an effective IUD commonly used by urban Indian women.
Reason: Copper -T stops the transport of sperms till the ampullary isthmic junction.
3. **Assertion:** CDRI Lucknow has developed Mala-D which is non steroidal, once a week pill
Reason: Hormonal contraceptives help to balance the hormonal level in body for proper functioning of gonads.
4. **Assertion:** ARTs are available for childless couples to have a baby but all cannot afford.
Reason: These are very specialized, costly techniques performed by specialists and these facilities are available in some cities only.
5. **Assertion:** Copper -T is effective contraceptive used by women.
Reason: Copper ions reduce the motility and fertilizing capacity of sperms, increase phagocytosis of sperms inside the uterus, hence prevent conception.

ANSWERS-

1. A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
2. C) Assertion is true but the Reason is false.
3. D) Both Assertion and Reason are false
4. A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
5. B) Both Assertion and Reason are true and the Reason is not the correct explanation of the Assertion.

CASE BASED QUESTIONS

1. REPRODUCTIVE AND CHILD HEALTH CARE PROGRAMME.

India was the first country in the world to adopt an official population policy and launch official family planning programme way back in 1952 which remains the mainstay of family planning efforts. During its early years, the programme focused on the health rationale of family planning. Family planning as a strategy for population stabilization received attention only after 1971 population census. This strategy resulted in an increase in the proportion of couples effectively protected from 12.4 percent during 1971-72 to 46.5 percent during 1995-96 but remained stagnant during 1995-96 through 2003-04 and decreased to 40.4 during 2010-11. After the launch of the National Rural Health Mission in 2005, the official family planning programme has been subsumed in the reproductive and child health component of the Mission. However, universal adoption of small family norm still remains a distant dream in India. During 2007-08, only about 54 percent of the currently married women aged 15-49 years or their

husbands were using a contraceptive method to regulate their fertility and the contraceptive prevalence rate appears to have stagnated after 2004. Moreover, contraceptive practice in India is known to be very heavily skewed towards terminal methods which mean that contraception in India is practiced primarily for birth limitation rather than birth planning

Reproductive and Child Health Care programme is a comprehensive sector wide flagship programme, under the umbrella of the Government of India's (GoI) National Health Mission (NHM), to deliver the RCH targets for reduction of maternal and infant mortality and total fertility rates.

Components of RCH Programme: Women's health, safe motherhood (including safe management of unwanted pregnancy and abortion women's development Child health (child survival and child development) Adolescent Health (sexuality development, adolescence education and vocational component)

- 1.1 What is the full form of RCH?
- A) Reproductive and Child Health Care
 - B) Reproductive and Child Health programme
 - C) Reproductive and Child Health Care programme
 - D) Reproductive and Child Health
- 1.2 Mention which of the following is not a major task under RCH programmes?
- A) Creating awareness about reproduction related aspects.
 - B) Providing facilities and support for building reproductively healthy society.
 - C) Sex determination of the unborn.
 - D) All the above.
- 1.3 RCH also aims to create awareness about problems due to uncontrolled population growth because-
- A) It increases cases related to sexual abuse and sex related crimes.
 - B) It increases various social evils like poverty, unemployment.
 - C) It increases the rate of basic requirements like food, shelter and clothing
 - D) All the above
- 1.4 According to 2001 census report, the population growth was still around _____ percent at which our population could double in _____ years.
- A) 17, 33
 - B) 18, 33
 - C) 17, 35
 - D) None of the above
- 1.5 **Assertion:** Human population now doubles every 35 years as against 200 years in 1600-1800.
Reason: Rapid increase is due to better health facilities and food resources.
- A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
 - B. Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
 - C. Assertion is true but the Reason is false.
 - D. Both Assertion and Reason are false. (Answers: 1.1-D, 1.2-C, 1.3-D, 1.4-A, 1.5-A)

2. CONTRACEPTIVES-

Contraception is defined as the intentional prevention of conception through the use of various devices, sexual practices, chemicals, drugs, or surgical procedures. Thus, any device or act whose purpose is to prevent a woman from becoming pregnant can be considered as a contraceptive. The different types of contraception-

- Cap.
- Combined pill.
- Condoms.
- Contraceptive implant.
- Contraceptive injection.
- Contraceptive patch.
- Diaphragm.
- Female condoms.

- In India, over 139 million women and girls now use a modern method of contraception, it further said. The report said 320 million women and girls in the world's 69 lowest-income countries now have access to family planning according to new figures released by Family Planning 2020 (FP2020).

2.1 What are the different reasons due to which contraceptive are used?

- A) To keep space between the children.
- B) To delay or avoid pregnancy/ pregnancy related complications.
- C) To avoid other problems like painful menstruations, skin problems, PCOD, etc.
- D) All the above.

2.2 Which of the following is not a characteristic feature of an ideal contraceptive?

- A) It should be cheap and easily available
- B) It should interfere with sexual drive of user.
- C) It should be effective with least side effects.
- D) All the above.

2.3 Government through RCH has promoted small families to overcome the problems associated with population explosion in our country through various means. Which of the following options is not an effort by the Government and RCH -

- A) Statutory raising the marriageable age of female to 18 years and that of males to 21 years.
- B) Media showing happy couple with many children.
- C) Popularising slogans like HUM DO HUMARE DO and urban working couples are adopting one child norm.
- D) Incentives given by government to people with small families.

2.4 Which of the following is not used as a contraceptive by females?

- A) Tubectomy
- B) Female Condoms
- C) Implants
- D) Cervical caps

2.5 **Assertion:** Amniocentesis is often misused detect the sex of the unborn baby.

Reason: Amniocentesis is meant for determining the chromosomal/genetic disorders in the fetus, but is being used to determine the sex of the fetus so that female fetus may be aborted.

- A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C. Assertion is true but the Reason is false.
- D. Both Assertion and Reason are false.

- (ANSWERS- 2.1-D, 2.2-B, 2.3- B, 2.4-A, 2.5-A)

3. CONTRACEPTIVES-

A wide range of contraceptives are available today to avoid pregnancy. The major categories of contraceptives include natural/ traditional, barrier, IUDs, oral contraceptives, injectable, implants and surgical methods. The natural / traditional method includes periodic abstinence, withdrawal or coitus interruptus, lactational amenorrhoea. Barrier methods (usage of condoms, diaphragms, cervical caps and vaults), IUDs (Intra Uterine Devices), pills (oral contraceptives) and sterilization by surgical methods (tubectomy and vasectomy) all are included in the artificial methods of contraception. IUDs and pills are the hormonal methods of contraception.

3.1 Which according to your knowledge of menstrual cycle are safe days for unprotected sex without having fear of conception?

- A) Between day 1 to day 10 of menstrual cycle and then between day 20-day 30 of menstrual cycle.

- B) Between day 1 to day 9 of menstrual cycle and then between day 18 - day 30 of menstrual cycle
 C) Between day 1 to day 12 of menstrual cycle and then between day 20- day 30 of menstrual cycle
 D) None of the above.
- 3.2 In some females just after the child birth, during the breast feeding phase, there is a phase of the absence of menstruation. This fully prevents conception.
 A) True B) False C) Not sure
- 3.3 Which is not the characteristic feature of Natural methods of contraception?
 A) Very effective B) No chances of failure when used. C) None of the above D) Both A and B
- 3.4 Which of the following is not a characteristic feature of Diaphragms, cervical caps and vaults?
 A) These are used by females
 B) These are reusable
 C) These block the entry of sperms through the cervix
 D) These are effective only when used with spermicidal creams, jellies and foams.
- 3.5 Assertion: IUDs are an ideal and most widely used contraceptive for the females in India.
 Reason: It gives freedom to males to take decision about delaying of pregnancy and/or space children for a period of 3-5 years.
 A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
 B) Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
 C) Assertion is true but the Reason is false.
 D) Both Assertion and Reason are false.

(ANSWERS- 3.1-B, 3.2- A, 3.3-D, 3.4-D, 3.5- C)

4. MEDICAL TERMINATION OF PREGNANCY (MTP)

Intentional or voluntary termination of pregnancy is called medical termination of pregnancy. Medical termination of pregnancy is also termed as induced abortion. MTPs are used to get rid of unwanted pregnancies and the pregnancies which could be harmful or fatal to the mother or to the foetus or both. MTPs are safe up to 12 weeks i.e. the first trimester of pregnancy. Government of India legalized MTP.

Nearly 45 to 50 million MTPs are performed in a year all over the world which accounts to 1/5th of the total number of conceived pregnancies in a year. Every day 13 women die in India due to unsafe abortion-related causes. Nearly 64 million pregnancies are terminated every year in India. Unsafe abortion, the third leading cause of maternal deaths in the country, contributes eight per cent of all such deaths annually.

- 4.1 Under which conditions it is not legal to perform MTP up to 12 weeks of pregnancy?
 A) When the continuation of pregnancy is dangerous for the life of mother.
 B) When continuation of pregnancy is dangerous for the life of father.
 C) In case of pregnancy due to rape.
 D) In case of chromosomal / genetic defect in foetus
- 4.2 If MTP is performed after it is detected that the sex of the foetus is female, then it is known as
 A) Female foeticide B) Amniocentesis
 C) Threatened abortion D) None of the above
- 4.3 MTP can imbalance-
 A) Population in a country B) Sex ratio C) Birth rate D) IMR
- 4.4 In which year Government of India legalized MTP?

A) 1975

B) 1991

C) 1971

D) 1981

4.5 Assertion: MTP is not to be performed after first trimester.

Reason: In second trimester, the maternal and foetal tissues are intricately inter digited that MTP can lead to excessive blood loss and death of mother.

- A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B) Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C) Assertion is true but the Reason is false.
- D) Both Assertion and Reason are false.

(ANSWERS-4.1-B, 4.2-B, 4.3-B, 4.4- C, 4.5- A)

5. SEXUALLY TRANSMITTED DISEASES- STDs constitute a major public health problem for both developing and developed countries. The emergence of HIV infection has increased the importance of measures aimed at control of STDs. A proper understanding of the patterns of STDs prevailing in different geographic regions of a country is necessary for proper planning and implementation of STD control strategies. It is with this aim that the authors have reviewed the relevant published literature from India over the past 25 years.

To sum up, bacterial STDs like chancroid and gonorrhoea are showing a declining trend, but the viral STDs like herpes genitalis and condylomata acuminata are showing upward trend. There is a decline in the number of patients with STDs attending the hospital. Whether this is due to an actual decrease in the incidence of STDs or due to other factors is uncertain. The increased availability of facilities for treatment of STDs at peripheral centers might be a factor leading to a decline in the number of patients with STDs approaching higher centers like the teaching hospital where this study was undertaken. The emphasis on the syndromic approach to the management of STDs might have increased the accessibility to healthcare for these patients with STDs. Awareness about HIV and fear of contracting the STDs are likely to have influenced the risk-taking behavior of people, thereby reducing the likelihood of being infected with STDs. Another factor to be considered is the widespread use of antibacterials, including quinolones and the new macrolides, for the treatment of other diseases. This can result in partial treatment or modified course of the bacterial STDs, thereby leading to apparent reduction in the total number of cases of STDs attending STD clinics as well as a decrease in the proportion of bacterial to viral STDs.

5.1 Which of the following is not a bacterial STD?

- A) Syphilis
- B) Gonorrhoea
- C) Herpes genitalis
- D) Chlamydia

5.2 Choose the odd one out-

- A) Genital herpes
- B) Genital warts
- C) Trichomoniasis
- D) Hepatitis B

5.3 Which of the following symptoms is not seen in case of an STD?

- A) Slight pain in genitals
- B) Swelling in the genitals
- C) Itching and fluid discharge from the genitals
- D) Redness/discoloration in the genitals

5.4 Which of the following is not a complication which arises when STDs are not treated on time?

- A) PID
- B) Infertility
- C) Cancer of the rectum
- D) Still births

5.5 Assertion: Persons in the age group between 15-24 years is more vulnerable to sexually transmitted infections.

Reason: People in reproductive age get sexually transmitted infections during sexual intercourse with their partner.

- A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B) Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C) Assertion is true but the Reason is false.
- D) Both Assertion and Reason are false.

(ANSWERS- 5.1-C, 5.2- C, 5.3-D, 5.4-C, 5.5-C)

6. ORAL CONTRACEPTIVES-

Oral Contraceptives are in the form of pills that are either progestogens (progesterone) or a progestin-estrogen combination. These are female contraceptives administered for 21 days in a month. Saheli is world's first and only oral non steroidal contraceptive pill. 'Saheli' aka Centchroman (ormeloxifene 30mg) is the only non-steroidal pill with zero side effects available in the world. The Government of India guidelines for Emergency Contraception recommend use of Levonorgestrel (progestogen only) NG 0.75 mg as a "dedicated product" for effective emergency contraception. The Drug Controller of India has approved only Levonorgestrel for use as ECP.

6.1 OCs are taken for a period of ____ days, starting within the first _____ days of menstrual cycle and after a gap of ____ days during which menstruation occurs it is repeated every month. (fill in the blanks)

- A) 21, 7, 5 B) 5, 7, 21 C) 21, 5, 7 D) None of the above

6.2 Saheli- an OC has the following features- It is non steroidal. It has many side effects. It is once a week pill. It has low contraceptive value.

- A) True B) False C) Not sure

6.3 Which is not true about the mode of action of OCs?

- A) They inhibit ovulation.
B) They suppress sperm motility and fertilizing capacity of sperms
C) They alter the quality of cervical mucus to retard sperms.
D) They inhibit implantation.

6.4 OCs contain -

- A) Progesterone only
B) A combination of oestrogen and progesterone
C) None of the above
D) Both the above

6.5 Assertion: Emergency contraceptives are used to avoid pregnancy due to casual unprotected sex or due to rape.

Reason: These are very effective if given within 72 hours of unprotected sex.

- A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
B) Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
C) Assertion is true but the Reason is false.
D) Both Assertion and Reason are false.

(ANSWERS- 6.1-C, 6.2-B ,6.3-B ,6.4-D ,6.5-A)

Competency Based Questions-

7. **INFERTILITY**: A large number of couples all over the world including India are infertile, i.e., they are unable to produce children inspite of unprotected sexual co-habitation. In the opinion of the Indian Society of Assisted Reproduction, about 10 to 14 % of Indians are infertile which amounts to about 27.5 million couples struggling with their dreams of starting a family and raising a child. Female infertility - 30-40% Male infertility- 30-40%. The reasons for this could be many-physical, congenital, diseases, drugs, immunological or even psychological.

General Causes of Infertility



Specialized health care units (infertility clinics, etc.) could help in diagnosis and corrective treatment of some of these disorders and enable these couples to have children. However, where such corrections are not possible, the couples could be assisted to have children through certain special techniques commonly known as assisted reproductive technologies (ART). All these techniques require extremely high precision handling by specialized professionals and expensive instrumentation. Therefore, these facilities are presently available only in very few centres in the country. Obviously their benefits are affordable to only a limited number of people.

Emotional, religious and social factors are also deterrents in the adoption of these methods. Since the ultimate aim of all these procedures is to have children, in India we have so many orphaned and destitute children, who would probably not survive till maturity, unless taken care of. Our laws permit legal adoption and it is as yet one of the best methods for couples looking for parenthood.

7.1 A woman has blockage in fallopian tubes which cannot be treated. Which ART would you suggest to this couple for becoming parents?

- A) GIFT (Gamete Intra fallopian transfer)
- B) ZIFT (Zygote intra fallopian transfer)
- C) IUT (Intra uterine transfer)
- D) Any of the above

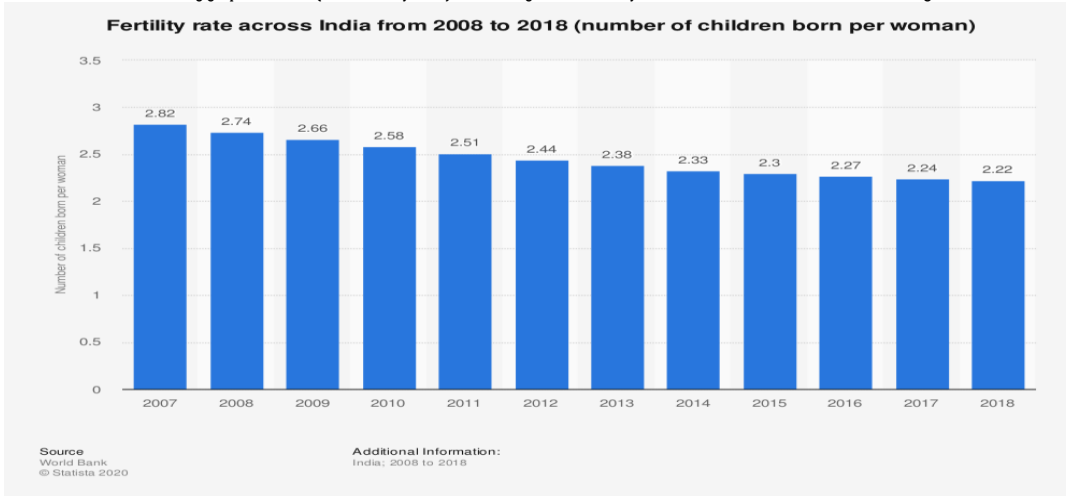
7.2 A male who cannot produce sufficient number of motile and functional sperms can have a baby by adopting which technique (suggest the best and cost effective technique)-

- A) GIFT (Gamete Intra fallopian transfer)
- B) ZIFT (Zygote intra fallopian transfer)
- C) ET (Embryo transfer)
- D) All of the above

7.3 A couple produces functional gametes but the female is unable provide conditions for fertilization of gametes .Which technique would you suggest to the couple to have a baby?

- A) GIFT (Gamete Intra fallopian transfer)
- B) ZIFT (Zygote intra fallopian transfer)
- C) AI (artificial insemination)
- D) None of the above

7.4 Observe the following graph. The TFR (total fertility rate) is declining on our country from 2007-2018. Which of the following is a reason for infertility in India?



- A) Psychological problems
- B) Immunological problems
- C) Congenital problems
- D) All the above

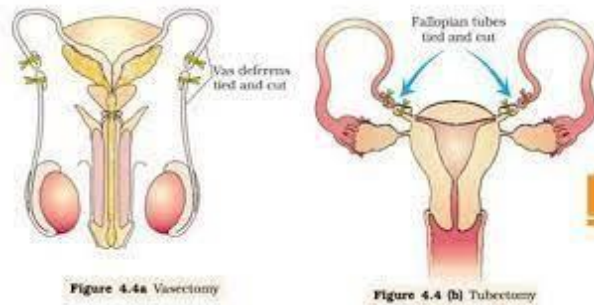
7.5 Assertion: **W**omen in India are often blamed if a couple is child less.

Reason: In a male dominating society like ours, women are blamed whereas problem always lies with the male partner.

- A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B) Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C) Assertion is true but the Reason is false.
- D) Both Assertion and Reason are false.

(ANSWERS- 7.1- C, 7.2-A ,7.3-B ,7.4-D ,7.5- C)

8. SURGICAL METHODS Observe the given picture and answer to the following questions-



8.1 A woman went to the doctor for permanent contraceptive method as she already has two children. The doctor advised her permanent method of contraception and explained her procedure, which is-

- A) tubectomy ,where both the oviducts are cut and tied.
 - B) Vasectomy, where both the vas deferens are cut and tied.
 - C) Oral emergency contraceptives
 - D) None of the above
- 8.2 Removal of gonads is not a method of contraception because-

- A) It stops gametogenesis for ever.
- B) It alters the sex hormonal balance in the body.
- C) It makes the person infertile
- D) All the above

8.3 Why are both the vas deferens cut and tied in vasectomy?

- A) To stop the transport of sperms out to the female reproductive tract.
- B) To stop the sperm from fertilizing the secondary oocyte in oviduct.
- C) To stop sperm production.
- D) All the above

8.4 Which of the following point is true about surgical methods of contraception?

- A) Highly effective and reversible and can be performed by quacks also.
- B) Less effective, irreversible and can be done only by qualified doctors
- C) Highly effective and irreversible so terminal method of contraception performed by qualified doctors
- D) Highly effective, reversible with few side effects.

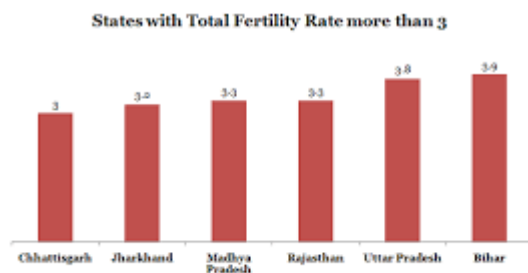
8.5 Assertion: **W**idespread use of contraceptive is an effective method to control population growth but it has possible ill effects also.

Reason: It can lead to conflicts between couples about when to have a child and how many to produce.

- A) Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B) Both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C) Assertion is true but the Reason is false.
- D) Both Assertion and Reason are false.

(ANSWER- 8.1-A, 8.2-D, 8.3-A ,8.4-C ,8.5-C)

9. POPULATION EXPLOSION



Source: National Population Stabilisation Fund

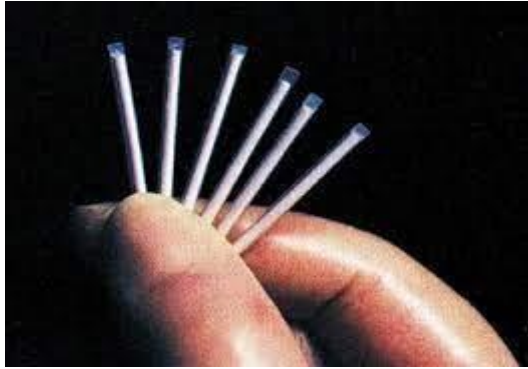
- 9.1 Observe the graph showing total fertility rates(TFR) across various states in India. Which state has maximum TFR ?
- A) Uttar Pradesh
 - B) Bihar
 - C) Rajasthan
 - D) Chhattisgarh
- 9.2 There is population explosion in the state which has highest TFR. So, what steps the state authorities must take to control population?
- A) Use mass media to educate people about advantages of small family.
 - B) Distribute free contraceptives- condoms, IUDs, OCs
 - C) Declare and popularise various incentives for small families
 - D) All the above.
- 9.3 What could be the possible reasons for population explosion in that state?
- A) Decline in death rate, IMR, MMR
 - B) Increase in number of people in reproductive age.
 - C) Increase in birth rate.
 - D) All the above.
- 9.4 What are the problems that this state is facing due to population explosion?
- A) Shortage of basic requirements like food, shelter and clothing
 - B) More working hands means more income.
 - C) Better standard of living of people with more children.
 - D) All the above.
- 9.5 If more and more couples in this state become infertile, then problem of population explosion can be solved?
- A) True
 - B) False

(ANSWERS- 9.1-B, 9.2-D, 9.3-D , 9.4-A , 9.5-B)

OTHER MULTIPLE CHOICE QUESTIONS-

1. Which of the following STDs is completely curable if timely and proper treatment is sought?

- A) HIV- AIDS B) Genital herpes C) Hepatitis-B D) Chancroid
2. Mention the precautions that the vulnerable age group people should take to avoid contracting the STDs-
- A) Avoid sex with unknown and multiple partners
 B) Use condoms during coitus
 C) Consult a qualified doctor in case of symptoms
 D) All the above
3. Which of the following is not a mode of action of IUDs?
- A) Increase phagocytosis of sperms
 B) Inhibit ovulation
 C) Make the cervix hostile to sperms and uterus unsuitable for implantation.
 D) Suppress sperm motility and fertilizing capacity of sperms
- 4.



- 4.1 Identify this contraceptive used by females-
- A) Injectibles B) Implants C) Emergency contraceptive d) Oral contraceptive
- 4.2 What is the basic chemical composition present in above contraceptive which makes it an effective contraceptive?
- A) Steroid hormones-Progesterone alone or combination with estrogen.
 B) Copper ions
 C) Both the above
 D) None of the above
5. What is the difference between implants and oral contraceptives?
- A) Implants are effective for longer duration.
 B) Implants are inserted under the skin; need not be remembered and taken daily.
 C) Both A and B
 D) None of the above

(ANSWERS: 1-D, 2- D, 3- B, 4.1-B, 4.2-A, 5- C)

CHAPTER-5 : PRINCIPLE OF INHERITANCE AND VARIATION

MCQ TYPE QUESTIONS :-

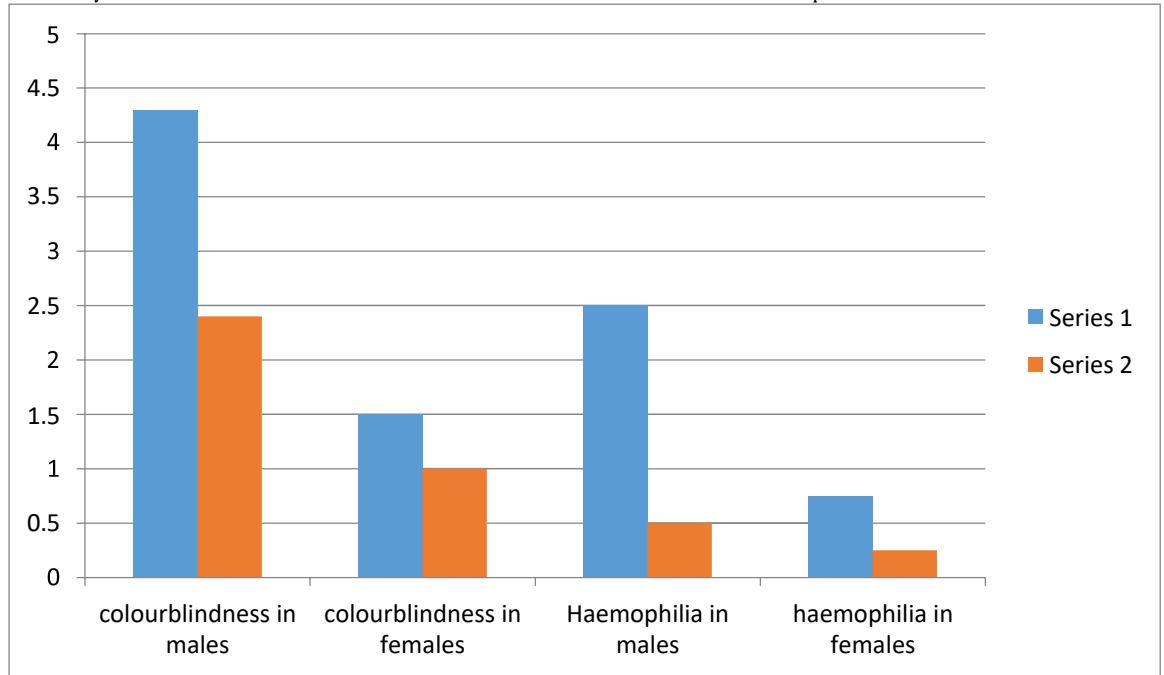
- Who rediscovered the Mendel's work:
a. Correns b. Hugo de Vries c. Tschermak d. All of the above
- In which year the Mendel's work has been published:-
a. 1864 b. 1865 c. 1866 d. 1867
- Who has given the concept of gene mapping:-
a. Morgan b. Gregor John Mendel c. Alfred Sturtevant d. Henking
- Male heterogametic condition found in :-
a. Human being b. Fowl c. Both A & B d. Not certain
- Who invented X chromosomes:-
a. MacClintock b. Johanson c. Morgan d. Henking
- Trisomy found in:-
a. Turner's Syndrome b. Klinefelter's syndrome
c. Down's Syndrome d. All of the above
- Failure of which stage of cytokinesis cause polyploidy:-
a. Prophase b. Metaphase c. Anaphase d. Telophase
- In phenylketonuria the amino acid phenylalanine fails to convert in which amino acid:-
a. Serine b. Tyrosine c. Glutamic Acid d. Valine
- In Sickle cell anemia, at which position, the amino acid get changed:-
a. Fourth position b. Fifth position c. Sixth position d. Seventh position
- If the diploid number of chromosomes are 32 in honey bees, then how many chromosomes found in the male honey bees or drones:-
a. 16 b. 32 c. 48 d. 16 & 32 both
- There is certain feminine features develop in an individual with XXY chromosomes configuration, then what is the suitable term can be given to the situation:-
a. Gynaecomastia b. Gynaecophilia
c. Gynaecoinducia d. Gynaecoblastia
- Which of the following disease belong to autosomal recessive Mendelian disorder:-
a. Colour blindness b. Haemophilia
c. Sickle cell anaemia d. All of the above
- Incomplete Dominance, is the deviation of which law of Mendel:-
a. Law of dominance b. Law of segregation
c. Law of independent assortment d. All of the above
- Pleiotropy, can be defined as:-
a. When one gene control one trait
b. When one gene exhibit multiple traits
c. When multiple genes control one trait
d. When multiple genes control multiple traits.
- Polygenic inheritance can be observed in:-
a. In the eye colour of human being
b. In the skin colour of human being
c. In the hair colour pattern
d. All of the above
- In fowl, which parent is responsible to determine the sex of offsprings :-
a. Male parent b. Female parent
c. Both parents d. By environment conditions
- In pea plants, the pod shape may be inflated or constricted, which trait is dominant trait:-
a. Inflated b. Constricted c. Both of them d. Not certain
- What would be the phenotype of a plant that has genotype Tt :-
a. Tall b. Dwarf c. Semi dwarf d. Not certain
- Out of sperms and ova, which gamete is responsible to determine sex in chick :-
a. Sperm b. Ovum

- c. Both the gametes
d. Depend upon environment conditions
20. What will be the percentage of pea plants that would be homozygous recessive in the F₂ generation, when tall F₁ heterozygous pea plants are selfed :-
a. 25% b. 50% c. 75% d. 100%
21. What percentage of homozygous and heterozygous populations are produced in F₂ generation in a Mendelian monohybrid cross:-
a. 25% and 25% b. 50% and 50%
c. 25% and 75% d. 25% and 50%
22. Write the genotypes Mendel obtained, after the cross between F₁ violet flowered plants with white flowered pea plant:-
a. VV & vv b. VV & Vv c. Vv & Vv d. Vv & vv
23. Which law of Mendel, has universally accepted
a. Law of dominance
b. Law of segregation
c. Law of independent assortment
d. None of these
24. RrYy has been crossed with rryy. Give a suitable term of the cross:-
a. Monohybrid cross b. Test cross c. Back cross d. Self cross
25. How many alleles are responsible to determine the skin colour of human being:-
a. 2 pairs b. 3 pairs c. 4 pairs d. 5 pairs
26. In a population of Drosophila, 25% offsprings are similar to their parents, reason behind this similarity is :-
a. Recombination b. Linkage c. Variation d. All of the above
27. In human being, the 2n=46, how many linkage groups are found on it:-
a. 23 b. 46 c. 23 pairs d. 46 pairs
28. In the male gamete of an organism 8 chromosomes are found. Out of which one is X chromosome. how many autosomes will be found in the gamete:-
a. 7 b. 8 c. 14 d. 16
29. Male honey bees produced by parthenogenesis, which type of cell division found during Gametogenesis of such male bees:-
a. Mitosis b. Meiosis c. Amitosis d. All of the above
30. Which of the following is x linked recessive disease:-
a. Sickle cell anemia b. Thalassemia
c. Phenylketonuria d. Haemophilia
31. Which of the following organism, has XO sex chromosome in male individuals:-
a. Human being b. Fowl c. Insects d. None of the above
32. A human zygote has XXY sex chromosome along with 22 pairs of Autosome, what will be the sex of the individual the individual developing from the zygote:-
a. Male b. Female c. Both A & B d. Not certain
33. There is a gene which is responsible to control the shape of the seeds and the size of the starch grains and the nature of protein coat around the seed. Which type of gene it would be:-
a. Polymorphic gene b. Pleiotropic gene c. Multiple genes d. All of the above
34. What are the number of chromosomes, retain the genes for Alpha thalassemia and beta thalassemia respectively:-
a. 11 & 16 b. 16 & 11 c. 16 & 20 d. 11 & 20
35. An individual human being has 45 chromosomes, which type of chromosomal disorders likely to occur:-
a. Down's syndrome b. Turner's syndrome
c. Klinefelter syndrome d. None of the above
36. A colour blind son born from normal parents, what would be the genotype of the maternal grandfather:-
a. X^cY b. X^cY^c c. XY d. None of the above
37. Mother's blood group is A and father's blood group is B and the daughter's blood group is O. What will be the blood group of other children:-

- a. A b. B c. AB d. All of the above
38. What are the outcome of gene mapping-
 a. The chances of recombination b. The chances of linkage
 c. To locate at the proper locus of a gene d. All of the above
39. Phenylalanine hydroxylase enzyme, responsible to convert :-
 a. Phenylalanine to glutamic Acid b. Phenylalanine to valine
 c. Phenylalanine to tyrosine d. Phenylalanine to glycine
40. What is the phenomenon that occurred in the failure of separation of homologous chromosomes, during meiosis-
 a. Non Isolation b. Non distinction c. Non disjunction d. Non separation
41. The genotype of affected individual with sickle cell anemia will be:-
 a. Hb^sHb^s b. Hb^sHb^a c. Hb^aHb^a d. Hb^aHb^s
42. During sickle cell anemia, in what form does the replacement can be seen in codon :-
 a. GAG to GTG b. GAGto GUG c. GAGto GCG d. GAG to CAG
43. A haemophilic son born to normal parents. Give the genotype of parents-
 a. Mother XX father XCY b. Mother X^hX , father XY
 b. Mother XX, father XY d. None of the above
44. Which of the following is not a wild type phenotype in drosophila-
 a. Miniature wings b. White eye c. White body d. Normal wing
45. How many contrasting characters are found in the pea plants:-
 a. 5 pairs b. 6 pairs c. 7 pairs d. 8 pairs
46. In which year chromosomal theory of inheritance was postulated:- a. 1900 b. 901 c. 1902 d. 1903
47. How does mendelian disorders caused:-
 a. Due to defected autosomal gene
 b. Due to defected X linked gene
 c. Due to defected autosomal as well as X linked gene
 d. None of the above
48. In complete linkage, the off springs with recombination, in F2 generation are:- a. 1.1% b. 1.2% c. 1.3%
 d. 1.4%
49. In incomplete linkage, the offsprings with parental combination in F2 generation are:- a. 68.2% b. 62.8% c. 68.3% d. 62.3%
50. Two heterozygous parents are crossed. if two loci are linked what would be the distribution of phenotypic features in F1 generation for a dihybrid cross:-
 a. Complete linkage b. Incomplete linkage
 c. Partial complete linkage d. Partial incomplete linkage
- Multiple allelism is the concept which tells us :-
 B) One gene control several traits
 C) Several genes control one treat
 D) One gene control one trait
 E) Several genes control several traits
 - Which example is given by ABO blood group pattern:-
 B) Codominance
 C) Incomplete dominance
 D) Polygenic inheritance
 E) Multiple allelism
 - In a monohybrid cross in F2 generation 64 dwarf plants have been produced. how many hybrid tall plants will be produced in the same cross-
 B) 64 b. 128 c. 192 d. 256
 - Why the traits of plants in F2 generation of mendelian monohybrid cross, not blended :-
 B) Because the factors are located at different loci
 C) Because due to no crossing over
 D) Because factors are found on different chromosomes
 E) All of the above

CRITICAL & CREATIVE THINKING QUESTIONS:-

The chances of colour blindness about 8 % of males and only about .4 % of females This is because the genes that lead to red green colour blindness are on the X chromosome. Males have only one X chromosome and females have 2. Another sex linked recessive disease, which shows its transmission from unaffected carrier female to some of the male progeny has been widely studied. In this disease a single protein that is a part of the cascade of proteins involved in the clotting of the blood is affected. Due to this in an affected individual a simple cut will result in nonstop bleeding. The heterozygous female (carrier) for haemophilia may transmit the disease to sons. The possibility of a female becoming a haemophilic is extremely rare because mother of such a female has to be at least carrier and the father should be haemophilic.



Note :- in each group bar 1 represent the individuals of less than 12 years of age. And bar 2 represent the individuals of more than 12 years of age.

GRAPH : DEPICTS THE VIABILITY OF INDIVIDUALS WITH X LINKED MENDELIAN DISORDERS

1. The reason for low viability of human females with haemophilia is :-
 - a. Non clotting of the blood
 - b. Loss of major volume of blood during menstruation.
 - c. Lack of the coagulating protein
 - d. All of the above.
2. What is the reason of the drastic loss of viability of affected males with haemophilia :-
 - a. Low volume of blood
 - b. Lack of the clotting protein
 - c. Less platelet count
 - d. All of the above.
3. Which protein is responsible for coagulation of blood :-
 - a. Fibrin
 - b. Albumin
 - c. Globulin
 - d. None of the above
4. Why the colour blindness is more common in male than females :-
 - a. It is caused by a recessive gene.
 - b. It is located on X chromosome.
 - c. Female can be of heterozygous genotype.
 - d. All of the above.
5. How carrier mother may not inherit colour blindness to her offsprings :-
 - a. Affected gene is only found on one X chromosome.

- b. Mother may inherit normal X chromosome to the new generation.
- c. Offsprings will be heterozygous genotype.
- d. All of the above.

CASE BASE STUDY QUESTIONS: - MENDELIAN DISORDERS

Broadly, genetic disorders may be grouped into two categories – Mendelian disorders and Chromosomal disorders. Mendelian disorders are mainly determined by alteration or mutation in the single gene. These disorders are transmitted to the offspring on the same lines as we have studied in the principles of inheritance. Most common and prevalent Mendelian disorders are Haemophilia, Cystic fibrosis, Sickle cell anemia, Colour blindness, Phenylketonuria, Thalassemia. The Mendelian disorders may be recessive or dominant. Similarly the trait may also be linked to the case of sex chromosome like haemophilia. It is evident that this X – linked recessive trait shows transmission from carrier female to male progeny. A Mendelian disorder caused if the mutated gene is found either in homozygous or in heterozygous forms. A recessive disease only expressed in the homozygous genotype, whereas the dominant diseases expressed in heterozygous genotype also. The defected gene may be found on to the autosome, like in thalassemia, the alpha type, gene is found on chromosome number 16 and beta type gene is found on chromosome number 11. On the other hand when the defected gene is on X chromosome, then it will be considered as X linked diseases. Father never transmit or inherit the X linked diseases to the son, because from father –Y chromosome get inherited to his son and this chromosome not has any gene of the diseases.

1. Which disease is not Mendelian Disease :-
 - a. Down's Syndrome
 - b. Sickle cell Anemia
 - c. Thalassemia
 - d. Phenylketonuria
2. A female with gene of colour blindness may be normal, because :-
 - a. One X chromosome has the defected /mutated gene
 - b. Both X chromosomes have defected/mutated gene
 - c. Y chromosome has the defected/muted gene.
 - d. Both A & B
3. A son not getting X linked Mendelian disease from affected father because :-
 - a. The gene is located on X chromosome.
 - b. Father inherit Y chromosome to his son.
 - c. X chromosome is inherited to the daughter.
 - d. All of the above
4. Sickle cell Anemia and thalassemia are different from each other :-
 - a. They created by autosomal genes.
 - b. They are related to the disorder of blood.
 - c. They are autosomal recessive diseases.
 - d. Sickle cell anemia is qualitative and thalassemia is quantitative diseases.
5. Which two colours can not be identified in the colour blindness :-
 - a. Blue & green
 - b. Red & green
 - c. Red & blue
 - d. Violet & blue

CASE BASED STUDY QUESTIONS :- PARTHENOGENESIS

In the population of honey bees, the male honey bees develop from unfertilized ovum, and the number of chromosomes found in the male bees are 16. The male honey bees are also called as drones. And they have half number of the chromosomes with respect to the females. Male bees are haploid and female bees are diploid. Female bees have 32 chromosomes. During Gametogenesis male bees perform mitosis, whereas the female bees perform meiosis. If we study the making of progeny among the honey bees, we found that the female bees make both male and female, and the male bees only make females. That is why the male not have father as well as male bees not have son. Meanwhile the male honeybees have grandfather and grandson as well.

1. Why mitosis not applicable during gametogenesis of female honeybees :-

- a. Female bees are haploid.
 - b. Female bees are diploid.
 - c. Female bees need to produce haploid offsprings.
 - d. Female bees need to produce male bees by parthenogenesis.
2. A male honey bee not has son because :-
 - a. The male gamete are not in proper number.
 - b. The male gametes are not used to make male offsprings
 - c. The male gametes are yet to be in diploid chromosome number.
 - d. The female gamete develop in to a male bee directly.
 3. What is the number of chromosomes in the queen honey bee :-
 - a. 16
 - b. 32
 - c. 48
 - d. Not certain
 4. What is the role of the mitosis in the Gametogenesis in male honey bees :-
 - a. It maintains haploid number of chromosomes
 - b. Since the male bees are haploid , so meiosis is not needed.
 - c. For the making of the diploid offsprings
 - d. All of the above.

CASE BASE STUDY QUESTIONS:- CO-DOMINANCE

In the case of co-dominance, the f₁ generation resembles both parents. A good example is different types of red blood cells that determine ABO blood grouping in human being. ABO blood groups are controlled by the gene I. The plasma membrane of the red blood cells has sugar polymers that protrude from its surface and the kind of sugar is controlled by the gene. The gene I has three alleles I^A, I^B and i. The alleles I^A and I^B produce a slightly different form of the sugar while allele i does not produce any sugar. Because humans are diploid organisms, each person possesses any two of the three I gene alleles. I^A and I^B are completely dominant over i, in other words when I^A and i are present, I^A expresses. (because it does not produce any sugar) and when I^B and i are present I^B expresses. But when I^A and I^B are present together both express their own types of sugars. This is because of co-dominance. Hence red blood cells have both A and B types of sugars. Since there are three different alleles, there are six different combinations of these three alleles that are possible, and therefore, a total of six different genotypes of the human ABO blood types.

1. The ploidy level of human being is :-
 - a. Haploidy
 - b. Diploidy
 - c. Triploidy
 - d. Not certain
2. Which of the following gene is not produce sugar :-
 - a. I^A
 - b. I^B
 - c. I^AI^B
 - d. i
3. how many types of sugars are found in red blood cells :-
 - a. A type sugar
 - b. B type sugar
 - c. Both A & B type sugar
 - d. A is rarely found and B is commonly found
4. How many alleles are responsible to determine blood group :-
 - a. 2
 - b. 3
 - c. 4
 - d. 5
5. How many types of genotypes are found to make the human blood group :-
 - a. 4
 - b. 5
 - c. 6
 - d. 7

Read the following Assertion and Reason based questions and select the most appropriate answer for the questions:-

- a. Assertion and reason both are correct, and reason is correct explanation of the assertion.
 - b. Assertion and reason both are correct, and reason is not correct explanation of the assertion.
 - c. Assertion is correct and reason is incorrect.
 - d. Assertion is incorrect and reason is correct.
1. Assertion:- the point mutation is the substitution or replacement of a single nucleotide from DNA. Reason: - Sickle cell anemia caused due to point mutation.
 2. Assertion: - Colour Blindness caused due to a recessive gene , which is found in X chromosome. Reason: - Colour blindness is an example of X linked Recessive disease.

3. Assertion : - there are three pairs of alleles , which responsible to control the human skin colour. Reason : - The inheritance of human skin colour called as Polygenic Inheritance.
4. Assertion : - The non disjunction of the homologous chromosome, is resulting as non proper distribution of the chromosomes.
Reason : - Down's Syndrome disease is caused due to the non disjunction of the chromosomes.
5. Assertion : - There are triple alleles, IA, IB, i responsible to control the blood group of human being.
Reason : - The controlling of one trait by number of alleles is called as multiple allelism.
6. Assertion : - when a pure red flowered and pure white flowered , dog flower plants are crossed together, pink flowered plants are produced in f-1 generation.
Reason : - this is the incomplete dominance, which create the pink colour of the flowers.
7. Assertion : - if the genotype is $-Tt$, The phenotype of the pea plant is tall.
Reason : - Mendel's first law – law of Dominance – work to create phenotype in the heterozygous genotype.
8. Assertion : - The life span of Drosophila , is about 2 weeks.
Reason: - for the linkage , T. H. Morgan selected , Drosophila as an experimental insect
9. Assertion : - Alfred Sturtevant , used the frequency of recombination, to measure the distance between genes.
Reason: - more frequency of recombination means , genes are located farther , low frequency of recombination means genes are located nearer.
10. Assertion : - In fowls , the female has **ZW** and male has **ZZ** sex chromosome.
Reason : - the sex determination in the fowls is done by the female, not by the male parent.
11. Assertion : - The male honey bees or the drones produced by parthenogenesis Reason : - Male honey bees perform mitosis during Gametogenesis.
12. Assertion : - In human female, XX is the sex chromosomal configuration. Reason : - The determination of the sex is done by both the parents .
13. Assertion : - in phenylketonuria , phenyl alanine is excreted by help of urine. Reason : - Phenyl alanine has poor absorption , by the kidney.
14. Assertion : - The possibility of a female becoming a haemophilic is extremely rare. Reason : - mother must be at least carrier and father must be affected by the disease.
15. Assertion : - beta thalassemia , production of beta chain affected.
Reason: - it caused due to mutation in one or both genes on chromosome no. 16.
16. Assertion : - Chromosomal disorders can be classified into aneuploidy or polyploidy. Reason : - Chromosomal disorders can be caused either gaining of extra copy number of chromosomes or an increase in a whole set of chromosome .
17. Assertion: - A male child can not be affected by colourblindness Reason:- mother is a carrier for colour blindness.
18. Assertion : - a female individual has rudimentary or non functional ovaries Reason:- Sterility of the female caused due to the Turner's Syndrome.
19. Assertion : - Genes and chromosomes have parallel behavior.
Reason : - Sutton & Boveri introduced chromosomal theory of inheritance to prove it
20. Assertion : - The work of Mendel , remain , unrecognized till 1900.
Reason : - Expression of the traits , did not blend with each other , was not accepted by his contemporaries

Study the following diagrams and give the answer of the following questions :-



- Which disease is represented in the karyotype :-
 - Turner's Syndrome
 - Klinefelter's Syndrome
 - Down's Syndrome
 - None of the above
- Which pair of chromosome karyotype is representing the defect :-
 - 20th pair
 - 21st pair
 - 22nd pair
 - 23rd pair
- What is the term used for such triple chromosomal condition :-
 - Triploidy
 - Trisomy
 - Triple chromosomes
 - All of the above
- Select the most appropriate symptoms of the disease :-
 - Big and wrinkled tongue
 - Broad flat face
 - Congenital heart disease
 - All of the above
- Why this condition appeared :-
 - Due to failure of segregation of chromosomes
 - Due to Aneuploidy
 - Due to an additional chromosome
 - All of the above

Study the following diagram and answer the question :-

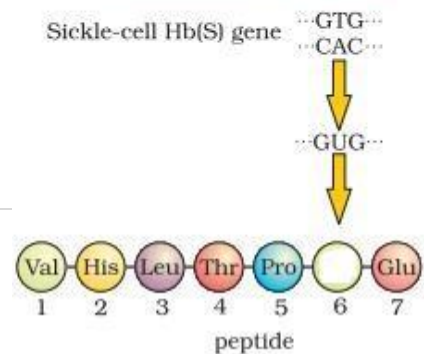
- Mention the chromosomes in the male and female bird respectively :-
 - XY & XX
 - XO & XX
 - ZZ & ZW
 - ZW & ZZ



- Which is the dominant trait of the position of flower:-
 - Terminal
 - Axial
 - Lateral
 - Sub terminal



- Which amino acid found at sixth position :-
 - Glutamic Acid
 - Valine
 - Glycine
 - Serine
- GUG codon is found in :-



- a. DNA
- b. t RNA
- c. r RNA
- d. m RNA

10. Which type of polypeptide is found at the end :-

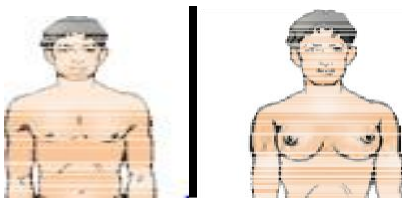
- a. HbA Polypeptide
- b. HbS Polypeptide
- c. Both A & B
- d. Normal Polypeptide

11. Which type of disease, does the sickle cell anemia is :-

- a. Autosomal Recessive disorder
- b. Autosomal Dominant Disorder
- c. X linked Recessive Disorder
- d. X linked Dominant Disorder

12. In the Hb(S) gene, which triple nucleotide, make codon GUG :-

- a. GTG
- b. CAC
- c. Both A & B
- d. None of the above



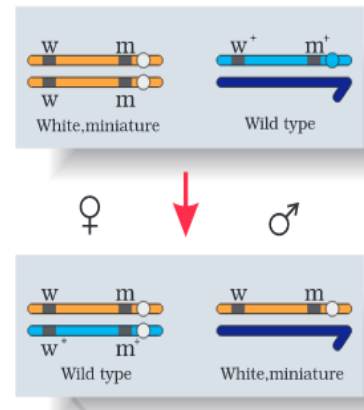
A B

13. Which individual exhibit Gynaecomastia :-

- a. A
- b. B
- c. Both A & B
- d. None of the above

14. Which type of cross is depicted in the above mentioned diagram :-

- a. Complete linkage
- b. Incomplete linkage
- c. Incomplete dominance
- d. Co-dominance



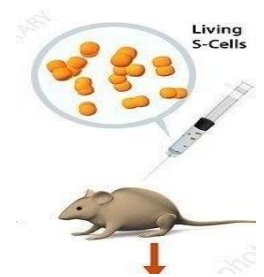
CHAPTER 6 MOLECULAR BASIS OF INHERITANCE

MCQS BASED QUESTIONS

- In a DNA strand, the nucleotides are linked together by-
(a) glycosidic bonds (b) phosphodiester bonds (c) peptide bonds (d) hydrogen bonds
- The size of DNA of bacteriophage lambda is
(a) 50000 bp (b) 48502 bp (c) 48602 bp (d) 58000 bp
- Nucleic acid is a polymer of
(a) Nucleoside (b) Nitrogenous bases (c) Phosphate gp (d) Nucleotides.
- The component of nucleoside are
(a) Pentose sugar, phosphate gp (b) Pentose sugar, Nitrogenous base (c) Nitrogenous base, Phosphate group
(d) None of the above
- Nucleotide contains
(a) Pentose sugar, nitrogenous base, phosphate group (b) Pentose sugar, nitrogenous base
(c) Nitrogenous base, phosphate gp (d) None
- Adenine pairs with thymine with
(a) 1 hydrogen bond (b) 2 hydrogen bond (c) 3 hydrogen bond (d) 4 hydrogen bond
- Cytosine pairs with guanine
(a) 3 hydrogen bond (b) 2 hydrogen bond (c) 1 hydrogen bond (d) 4 hydrogen bond
- Nitrogenous bases present in DNA are
(a) Adenine, Guanine, Cytosine, Uracil (b) Adenine, Guanine, Cytosine, Thymine (c) Adenine, Guanine, Cytosine (d) Guanine, Cytosine, Uracil
- Which statement about Polynucleotide chain is not true?
a) a nucleoside has three components- nitrogenous base, pentose sugar and phosphate group (b) Adenine and Guanosine are Purines
(c) two nucleotides are joined by Phospho-di-ester linkage to form dinucleotide (d) a polynucleotide has a free phosphate moiety and -OH at two opposite ends
- Which of the following is not true or DNA double helix structure?
(a) two nucleotides have anti-parallel polarity
(b) bases in two strands are linked by Hydrogen bonds
(c) Two chains are coiled in a left handed fashion
(d) pitch of the helix is 3.4 nm
- When & Who discovered double helical model of DNA Identify the correct option.
(a) 1952, Rosalind Franklin & Maurice Wilkins
(b) 1953, Watson & Crick (c) 1953, Watson & Rosalind Franklin
(d) 1955, Watson & Rosalind Franklin

- 12 Central dogma states that genetic information flows from
 (a) DNA · RNA → Protein b. RNA· Protein· DNA c. Protein·RNA·DNA d.RNA· DNA·Protein
- 13 Find the correct statement from below
 (a) In prokaryotes, DNA being positively charged is held by some negatively charged proteins to form nucleoid
 (b) in eukaryotes, there is a set of negatively charged proteins called histones
 (c) Histones are rich in lysine and Arginine residues
 (d) 6 molecules of histones with DNA forms nucleosome
- 14 The size of nucleosome
 a) 20 bp b) 200 bp c) 250 bp d) 150 bp
- 15 Which of the following statement is not correct?
 a) DNA is positively charged
 b) Histone proteins are positively charged
 c) Histone proteins are rich in lysine & Arginine
 d) Euchromatin is transcriptionally active
- 16 Identify the incorrect statement regarding transforming principle.
 a) Done by Frederick Griffith in 1928
 b) Used Streptococcus bacteria
 c) S strain is non virulent
 d) Experimental organism is mice
- 17 Biochemical characterisation of transforming principle is done by
 a) Avery, McLeod & McCarty
 b) Frederick Griffith
 c) Avery & McCleod
 d) None
- 18 Identify the incorrect statement regarding Hershey & Chase experiment
 a) Experiment proves that DNA is the genetic material.
 b) They used bacteriophage
 c) Protein labelled with ^{32}P & DNA with ^{35}S
 d) Bacteriophage is a virus
- 19 A genetic material must fulfill certain criteria. Which one of the following is not such a criterion?
 a) It should Replicate
 b) It should be chemically and Physically stable
 c) It should mutate fast required for evolution
 d) It should express in the form of Mendelian Characters
- 20 In a DNA helix, the distance between two consecutive bases on the same chain is
 a) 2 nm b) 3.4 nm c) 0.34 nm d) 34 nm
- 21 The term used by Mendel for inheritance molecules
 a) Genes b) Factors c) Alleles d) None
- 22 Identify the incorrect statement
 a) Purines are Adenine & Guanine
 b) Pyrimidines are Cytosine, Thymine, Adenine
 c) Adenine pairs with thymine by 2 Hydrogen bond

- d)Guanine pairs with cytosine by 3 hydrogen bond
- 23 RNA is labile due to presence of a)Hydrogen at 2' C in Ribose sugar
b) OH at 2' C in Ribose sugar
c) OH at 2' C in Deoxyribose sugar
d) None of the above
- 24 Which of the genetic material mutate at faster rate? a)RNA b)DNA c)Both
d)None
- 25 DNA is structurally stable due to .
a)Presence of thymine b)Presence of uracil c)Presence of adenine d)None
- 26 The first genetic material is
(a)Protein (b) Carbohydrates (c)DNA (d) RNA
- 27 WHAT IS hnRNA
a)HUMAN RNA b)HYPER NUCLEAR RNA
c)HETERONUCLEAR RNA d)HETEROGENEOUS NUCLEAR RNA
- 28 WHAT WILL BE THE EFFECT OF THIS EXPERIMENT ON RAT (A)RAT COAT BECOMES SMOOTH
(B) RAT DIES
(C) RAT IS UNAFFECTED
(D) RAT BODY SHOW PHAGOCYTOSIS AND NO PNEUMONIA
- 29 The promoter site and terminator site for transcription are located at-
(a) 3' (downstream) end and 5' (upstream) end respectively of transcription unit
(b) 5' (upstream) end and 3' (downstream) end respectively of transcription unit
(c) 5' (upstream) end
(d) 3' (downstream) end
- 30 With regard to mature mRNA in eukaryotes, which of the following is true ?
(a) Exons and introns do not appear in the mature RNA
(b) Exons appear but introns do not appear in the mature mRNA
(c) Introns appear but exons do not appear in the mature mRNA
(d) Both exons and introns appear in the mature mRNA
- 31 If the number of base pairs in a double stranded DNA is 200. The number of ADENINE is 60 then what will be the numbers of GUANINE.
a)60 b)40 c)80 d)100
- 32 Discontinuous synthesis of DNA occurs on one strand because
(a) DNA molecule being synthesized is very long
(b) DNA dependent DNA polymerase catalyses polymerisation only in one direction (5-3')
(c) It is a more efficient process
(d) DNA ligase has to have some role
- 33 Which of the following are the functions of RNA ?
(a) It is carrier of genetic information from DNA to ribosome synthesizing polypeptides
(b) It carries amino acids to ribosomes
(c) It is constituent component of ribosomes
(d) All of the above
- 34 RNA polymerase II is responsible for the transcription of
(a) tRNA B. rRNA C. hnRNA D. snRNA
- 35 In eukaryotic cell, transcription, RNA splicing and RNA capping take place in



- (a) Nucleus (b) Cytoplasm (c) Ribosomes (d) Golgi body
- 36 Choose Stop codons among the following:
a) UAA b) UCA c) UCC d) UAC
- 37 Triplet UUU codes for
(a) leucine (b) methionine (c) phenylalanine (d) glycine
- 38 A gene of operon which forms the repressor protein is
(a) Operator (b) Promoter (c) Regulator (d) Structural
- 39 In the absence of lactose, the operator gene of lac-operon is suppressed by genetic material
(a) Structural gene (b) Repressor protein
(c) Regulator gene (d) Promoter gene
- 40 Control of gene expression takes place at the level of
(a) DNA replication (b) Transcription
(c) Translation (d) None of these
- 41 In E-coli, the lac operon gets switched on when
(a) lactose is present and it binds to the repressor
(b) repressor binds to operator region
(c) RNA polymerase binds to the operator.
(d) lactose is present and it binds to RNA polymerase
- 42 Which of the following play a role in protein synthesis?
(a) Introns (b) Exons
(c) Both (a) and (b) (d) None of the above
- 44 Repressor protein is produced by
(a) Regulator gene (b) Operator gene
(c) Structural gene (d) Promoter gene
- 45 The protein of DNA, which contains information for an entire polypeptide is called as
(a) Cistron (b) Muton
(c) Recon (d) Operon
- 46 WHAT IS THE FIRST AMINO ACID ADDED DURING PROTEIN SYNTHESIS
a) GLYCINE
b) METHYLEME
c) METHIONINE d) VALINE
- 47 WHAT IS THE TYPE OF CENTRIFUGATION IS USED IN MESELSON AND STAHL EXPERIMENT
a) CaCl₂ DENSITY GRADIENT CENTRIFUGATION
b) CsCl DENSITY GRADIENT CENTRIFUGATION
c) NaCl DENSITY GRADIENT CENTRIFUGATION
d) BUFFER MEDIATED GRADIENT CENTRIFUGATION
- 48 If a person has VNTR of 10 nucleotides in his satellite DNA of chromosome no 8 then what will be the VNTR of his son and daughter of that chromosome?
a) both son and daughter will have the same.
b) son will have 8 but daughter will have 4.
c) it can't be determined.
- 49 Satellite DNA is an example ofDNA which shows DNA ----- which is ..
..... in nature. Choose right sequences of the answers
a) genomic , inheritable , variable
b) repetitive , polymorphism , variable
c) polymorphism , variable, repetitive
d) repetitive , polymorphism , inheritable
- 50 Identify the incorrect statement regarding DNA fingerprinting
a) Bulk DNA forms a major peak
b) Satellite DNA is a repetitive DNA

- c) Satellite DNA code for proteins
 d) Minisatellite & Microsatellite is a satellite DNA

ANSWER-

SR. NO	ANSWER	SR. NO	ANSWER	SR. NO	ANSWER
1	b	21	b	41	a
2	b	22	b	42	b
3	d	23	b	44	a
4	b	24	a	45	a
5	a	25	a	46	c
6	b	26	d	47	b
7	a	27	d	48	a
8	b	28	b	49	d
9	a	29	b	50	c
10	c	30	b		
11	c	31	b		
12	a	32	b		
13	c	33	d		
14	b	34	c		
15	c	35	b		
16	c	36	a		
17	a	37	c		
18	c	38	c		
19	c	39	b		
20	c	40	b		

ASSERTION -REASON TYPE QUESTIONS:

These questions consist of two statements each, printed as Assertion and Reason. While answering these questions you are required to choose any one of the following four responses.

- A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C. If Assertion is true but the Reason is false.
- D. If both Assertion and Reason are false

- 1 Assertion: Both deoxyribose and ribose belong to the same class of sugar called pentoses.
Reason : They differ only at the 3' C of the pentose sugar.
- 2 Assertion : DNA and histone proteins are both charged materials
Reason : DNA is negatively charged and HISTONE proteins are positively charged.
- 3 Assertion: DNA is considered as stable genetic material than RNA .Reason: It allows less mutation than RNA and it is double stranded.
- 4 Assertion: AUG codon has dual function.
Reason : AUG acts as start codon and it codes for methionine.
- 5 Assertion:DNA replication is semi conservative in nature .
Reason : The new DNA formed has both strands newly formed.
- 6 Assertion: Mathew Meselson and Franklin Stahl performed experiment using Heavy N source in nutrition medium for the growth of bacteria.
Reason: Density gradient centrifugation was used to separate the heavy DNA particles
- 7 Assertion: During DNA replication both strands are replicated in same direction.
Reason: DNA replication can do replication in any direction.
- 8 Assertion : Transcription takes place on the template strand.
Reason : The polarity of template strand is 3' to 5'.
- 11 Assertion:In prokaryotes transcription and translation takes place simultaneously.
Reason : There is no nuclear boundary in prokaryotes.
- 12 Assertion: The genetic code is degenerate.
Reason: Some amino acids are coded by more than one codon.
- 13 Assertion: Sickle-cell haemoglobin has a valine in place of glutamic acid at position 6 in the β polypeptide chain.
Reason: Sickle-cell anaemia is expressed only in homozygous recessive state.
- 14 Assertion: DNA fingerprinting is very well known for its application in paternity testing in case of disputes.
Reason: It employs the principle of polymorphism in DNA sequences as the polymorphisms are inheritable from parents to children.
- 15 Assertion: Human Genome Project was a mega project launched to find out the complete DNA sequence of human genome.
Reason: It was possible only with the help of genetic engineering techniques to isolate and clone any piece of DNA and fast techniques for determining DNA sequences
- 16 Assertion: Lactose in lac operon is INDUCER
Reason: Lactose inactivates the repressor gene.
- 17 Assertion: No lac mRNA is made in the presence of glucose.
Reason: In the presence of glucose and lactose activity of lac operon is not needed.
- 18 Assertion : Genetic codon is nearly universal.
Reason :as from bacteria to human it codes for same amino acids with some exceptions like in mitochondrial codons
- 19 Assertion: DNA finger printing is based on polymorphisms in repetitive DNA.
Reason:The polymorphisms are inheritable in nature.
- 20 Assertion:Assertion: 99.9% nucleotide bases are exactly the same in all people.

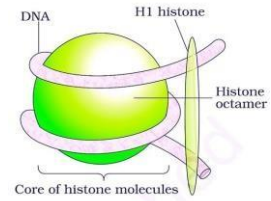
Reason: There are many locations where SNPs occur in human genome.

CASE STUDY / DIAGRAM BASED QUESTIONS

1. Observe following diagram and give answers.

i) Identify the structure in following diagram

- a) Ribosome
- b) Nucleosome
- c) Histosome
- d) Centrosome



ii) How many base pair of DNA Helix are found in the structure?

- a) 1000
- b) 500
- c) 200
- d) 100

iii) Which amino acid are found richly in histone protein.

- a) Glycine and Proline
- b) Proline and Arginine
- c) Lysine and Arginine
- d) Lysine and Glycine

iv) How many molecules are found in one Histone unit.

- a) 1
- b) 2
- c) 4
- d) 8

v) What is the chemical nature and charge of Histone protein

- a) Acidic and Positive
- b) Basic and Negative
- c) Basic and Positive
- d) Acidic and Negative

2. Observe following diagram and give answers.

i) Identify the following diagram?

- a) Replicating fork
- b) ORI
- c) Template strand
- d) Coding strand

ii) Give the term for Starting point of Replication

- a) ORI
- b) ARS
- c) ROP
- d) SSB

iii) Give the term for DNA fragments produced by Discontinuous synthesis.

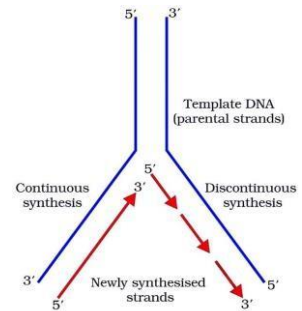
- a) Sokazaki Segment
- b) Mokazaki Segment
- c) Okazaki Segment
- d) Zokazaki Segment

iv) Give the name of enzyme which bind DNA fragments produced by Discontinuous synthesis.

- a) DNA Ligase
- b) DNA Polymerase
- c) DNAase
- d) Endonuclease

v) In which stage of cell cycle this structure is formed.

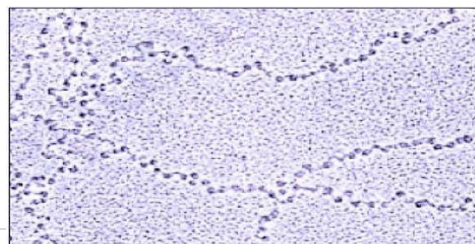
- a) G1
- b) G2
- c) S
- d) M



3. Observe following diagram and give answers.

i) Identify the following diagram.

- a) EM Picture- Bead in String
- b) Nucleosome
- c) Linker DNA
- d) Histone



ii) Give the term for Regions in given structure which are loosely packed and stains lightly.

- a) Heterochromatin b) Euchromatin
c) Pseudochromatin d) None of above

iii) Give the term for Regions in given structure which are densely packed and stains dark.

- a) Heterochromatin b) Euchromatin c) Pseudochromatin d) None of above

iv) Give the scientific term for Bead on string structure.

- a) Chromatin b) Nucleosome c) Linker DNA d) Histone

v) In which stage of cell division chromatin is modified in chromosomes and seen clearly.

- a) Prophase b) Metaphase c) Anaphase d) Telophase

4. Study the following crime case in which DNA finger print of two individual suspects A and B obtained from their DNA sample and DNA sample from the crime scene has the DNA fingerprint C to answer the following questions:

i) The technique to obtain separate bands of DNA fragments

is

- a) PCR b) Gel electrophoresis
c) DNA fingerprint d) Souther blotting.

ii) These short tandem repeats are present in

- a) Satellite DNA
b) ANY part of DNA
c) Homologous DNA
d) Single strand DNA

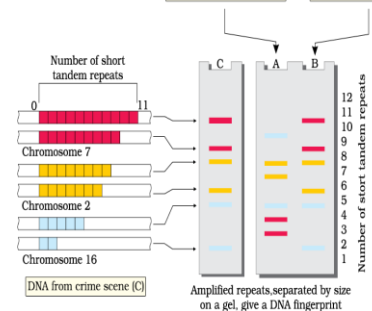
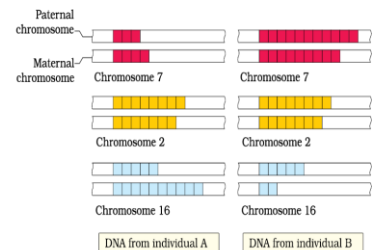
iii) This technique relies on which characteristics of DNA polymorphisms

- a) they are variable
b) they are inheritable
c) they are different from individual to individual
d) they are short DNA fragments
i) only a ii) b, c and d iii) b and c iv) all of the above

iv) Is it right to compare the VNTR of chromosome no 16 of C with the chromosome no 7 of the suspects. Yes/no

v) The red bands of chromosomes are obtained at

- a) anode pole of gel electrophoric plate.
b) cathode pole of gel electrophoric plate.
c) neutral pole of gel electrophoric plate.
d) any where of gel electrophoric plate.



5. Read following and give answers.

Genghis Khan, the fearsome Mongolian warrior of the 13th century, may have done more than rule the largest empire in the world; according to a recently published genetic study, he may have helped populate it too. An international group of geneticists studying Y-chromosome genome data under HGP have found that nearly 8 percent of the men living in the region of the former Mongol empire carry y-chromosomes that are nearly identical. That translates to 0.5 percent of the male population in the world, or roughly 16 million descendants living today.

- i) Identify the phenomena mentioned above.
 - a) Human genome project
 - b) Density gradient separation
 - c) Radioactive marking
 - d) Heavy Isotope marking

- ii) Which chromosome has fewest genes.
 - a) 1st b) X c) Y d) 3rd

- iii) Which chromosome has most genes.
 - a) X b) Y c) 1st d) 2nd

- iv) major approaches involved in Methodologies of HGP
 - a) Expressed Sequence Tags (ESTs) b) Sequence Annotation
 - c) Both a and b d) None of above

- v) Which is not a goal of HGP.
 - a) Identify all the approximately 20,000-25,000 genes in human DNA
 - b) Determine the sequences of the 3 billion chemical base pairs that make up human DNA
 - c) Store this information in databases & Improve tools for data analysis
 - d) Inhibition of transfer related technologies to other sectors, such as industries

	1	2	3	4	5
i	B	A	A	A	A
ii	C	A	B	A	C
iii	C	C	A	iii	C
iv	D	A	B	NO	C
v	C	C	B	B	D

Term II

CHAPTER-8 : HUMAN HEALTH AND DISEASE

MCQ QUESTION

Q.1 Choose and write the correct option in the following questions.

1. Cancer causing genes are called.

- a) Structural genes b) Expresser genes c) Oncogenes d) Regulatory genes

Answer-c

2. AIDS is caused by HIV. Among the following, which one is not a mode of transmission of HIV?

- a) Transfusion of contaminated blood b) Sharing the infected needles
c) Sharing hands with infected persons d) Sexual contact with infected persons

Answer-c

3. Antivenom against snake poison contains.

- a) Antigen b) Antigen-antibody complexes
c) Antibodies d) Enzymes

Answer -c

4. Which of the following is not the causal organism for ringworm?

- a) Microsporium b) Trichophyton
c) Epidermophyton d) Macrosporium

ANSWER—d

ASSERTION –REASON QUESTIONS

Q.1 **ASSERTION** :Interferons are protein which are produced by virally infected cells

REASON :-Interferons stimulate inflammation at the site of injury .

- a) Assertion and reason both are correct statement and reason is correct explanation for assertion.
b) Assertion and reason both are correct statement and reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

Answer-c

Q.2 **ASSERTION** : Tobacco contains nicotine which stimulate the adrenal gland

REASON : Nicotine increase the blood pressure and the heavy rate.

- a) Assertion and reason both are correct statement and reason is correct explanation for assertion.
b) Assertion and reason both are correct statement and reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

ANSWER-b

Q.3 **ASSERTION** :Allergens cause excessive immune response in human body.

REASON : Allergy involves IgA antibodies and interferons.

- a) Assertion and reason both are correct statement and reason is correct explanation for assertion.
b) Assertion and reason both are correct statement and reason is not correct explanation for assertion.

- c) Assertion is correct statement but reason is wrong statement.
 d) Assertion is wrong statement but reason is correct statement

ANSWER-C

VERY SHORT ANSWER QUESTION (1 MARK QUESTION)

- Q.1 Which disease is confirmed by widal Test? Name the pathogen? Ans- Typhoid ,Salmonella typhi
 Q.2 How does haemozoin affect the human body when released in blood During malarial infection?
 Ans- Haemozoin is responsible for the chill and high fever recurring Every three to four days during malarial infection.
 Q.3 'Pranay suffered from measles at the age of 10 years . There are rare chances of his Getting infected with the same disease for the rest of his life. ||Give reason for the Statement.
 Ans- First exposure to the infection works as vaccination ,the immune system of the body Gets familiar with nature of microorganisms and specific antibodies can be produced against infection.
 Q.4 High fever ,loss of appetite ,stomach pain and constipation are some of the symptoms seen a patient .How would the doctor confirm that the patient is suffering from typhoid and not amoebiasis?
 Ans- By performing Widal-test.
 Q.5 Why do pollen grains of some flower trigger 'sneezing' in some people? Ans- Pollen grains trigger sneezing by causing allergic reaction.

SHORT ANSWER QUESTION (2 MARKS QUESTION)

- Q.1 Thymus of a new born child was degenerating right from birth due to a genetic Disorder.Predict its two impacts on the health of the child.
 Ans- Thymus provides micro-environment for the development and maturation of T-lymphocytes and provide immunity
 Q.2 Certain diseases are spread by mosquitoes and two such diseases are spread By a mosquito which bites in the day time. Both the diseases are caused by viruses.
 a) Name the mosquito.
 b) Name the diseases with one symptom of each.
 Ans— Aedes
 b) Dengue—muscular pain, Chickungunya —very high fever.
 Q.3 A child gets colostrum and polio drop both as an infant .Compare their mode of action with respect to our immune system.
 Ans- Colostrum provides passive immunity to child. Polio drop/ vaccine provides active immunity.

SHORT ANSWER QUESTION (3 MARKS QUESTION)

- Q.1 A person shows strong unusual hypersensitive reactions when exposed to certain substances present in the air ,identify the condition . Name the cells responsible for such reactions .What precaution should be taken to avoid such reactions.
 ANS- The condition is called allergy . Mast cell responsible for such reaction .
 Precaution--- 1. Use drug like antihistamine adrenaline and steroid.
 2. Avoid contact with substances to which a persons is hypersensitive.
 Q.2 Many microbial pathogens enter the gut of human s along with food. What are the preventive barriers to protect the body from such pathogens? What type of immunity do you observe in this case ?
 ANS- Preventive barriers to protect the body from such pathogens
 i) The mucus coating of the epithelium lining of the gut helps in trapping microbes entering the body.

- Q.3
- ij) Saliva in the mouth and HCL in gastric juice secreted by stomach prevent microbial growth. It is innate immunity.
- Tarun was one of the best boys in the class. In spite of his efforts he was not doing well in class.
- xi. His father wanted him to qualify for medical sciences. He got frustrated with his results due to drugs. He started misbehaving with parents and friends in school. His friends started neglecting him. The school authorities counseled Tarun but to no effect. His parents were upset and took him to a rehabilitation Centre. After a few months he came back recovered.
- What is drug abuse?
 - Name some commonly abused drugs and their source.
 - What should be the attitude of his parents after his return?
 - ASSERTION:** Drugs like Barbiturates and Benzodiazepines normally used as medicine to help the patients to cope up with mental illness.
REASON: When these substances are taken for a purpose other than medical use, constitute the drug abuse.
- Assertion and reason both are correct statement and reason is correct explanation for assertion.
 - Assertion and reason both are correct statement and reason is not correct explanation for assertion.
 - Assertion is correct statement but reason is wrong statement.
 - Assertion is wrong statement but reason is correct statement.

ANS--a) Intake of drugs for a non –medical purpose in the dose, strength, frequency and the way of taking which impairs mental and physical functions of human being is drug abuse.

- OPIUM** : From plant Papaver somniferum its derivatives includes morphine, codeine, heroin, smack (brown sugar)
Cocaine : From Erythroxylon coca its derivatives includes Crack, Caffeine
LSD : From fungi Claviceps purpurea
- Parents should be compassionate and more caring towards the child. Behave normally. (ANY other may be included) open added question.

d) Assertion and reason both are correct statement and reason is not correct explanation of the assertion.

Q4. Fill in the spaces/ blanks in the following flow chart

- Mosquito bites a healthy human and injects sporozoites.
- Sporozoites reach the _____ a _____ through _____ b _____
- Reproduces _____ c _____ burst the cells and release into blood
- Enter the _____ d _____
- Some of them form _____ f _____ that are picked up by a mosquito when it bites.

ANS- a. liver, b. blood, c. asexually, d. haemozoin, e. gametocytes.

Q.5 Fill in the blank columns in the given table.

Disease	Causal organism	Medium of transfer	Symptoms
Amoebiasis	Causal Entamoeba histolytica	A a	Diarrhoea
Typhoid	Bb b	Contaminated food and water	Sustained high fever
C ccc c	Plasmodium	Bite of infected female	Chill and high fever

		anopheles mosquito	
--	--	--------------------	--

- a -----Contaminated food
b ----- Salmonella typhi
c -- Malaria

LONG ANSWER QUESTION (5 MARKS QUESTION)

Q.1 In India horoscopes of girl and boy are matched before fixing marriage. But Smita was against this, rather wanted future groom's blood to be tested for HIV. When asked for HIV test, the groom and his parents disagreed and left immediately.

- Was Smita wrong in wanting the future groom's HIV blood test done?
- Write the name of test for AIDS?
- Why did Smita want to get the boy's HIV test done?
- Which cell and tissue are affected by the HIV?
- Which enzyme converts RNA to DNA?

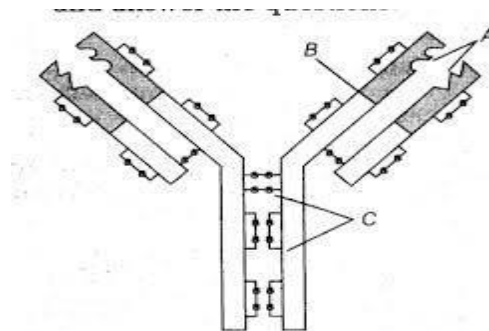
- ANS—
- No, Smita was not wrong.
 - ELISA-Enzyme linked immunosorbent assay.
 - HIV causes AIDS. It can spread through sexual contact. If the boy is HIV positive, she may get the virus, her future baby may also suffer from AIDS.
 - T helper cell and macrophage.
 - Reverse transcriptase.

Q.2 HIV, after infection takes few months to many years to exhibit its symptoms till then its prevention is a challenging task. Describe any two methods of early diagnosis of the deadly disease AIDS. How does HIV complete its life cycle? Also give illustrative diagram.

ANS- Correct explanation of ELISA test and PCR. Correct explanation with supportive illustrative diagram of HIV life cycle.

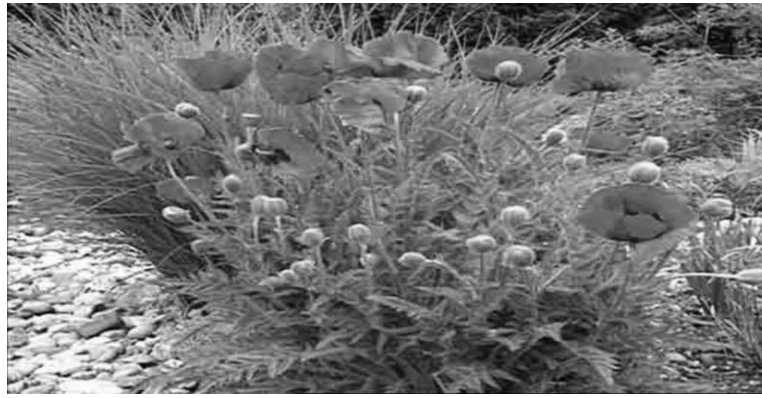
DIAGRAM BASED QUESTION

1. Identify the molecule and name A, B and C in the figure



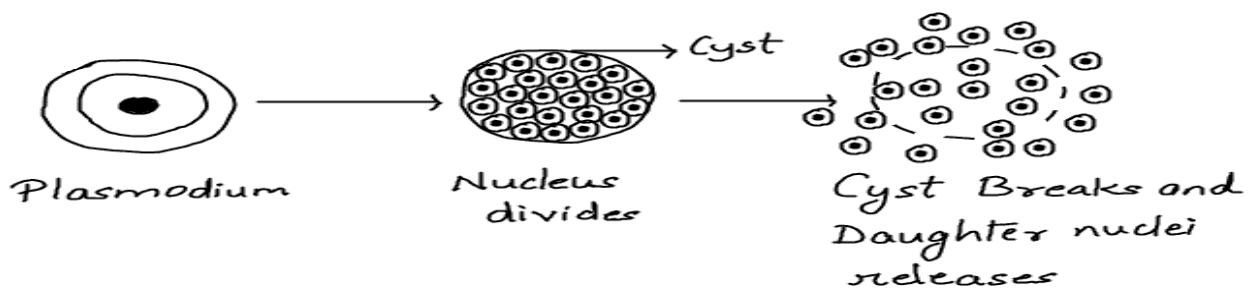
Ans. A= antigen binding site, B= Heavy chain, C= disulphide bonds

2. Identify the plant and name the drug obtained from this plant.



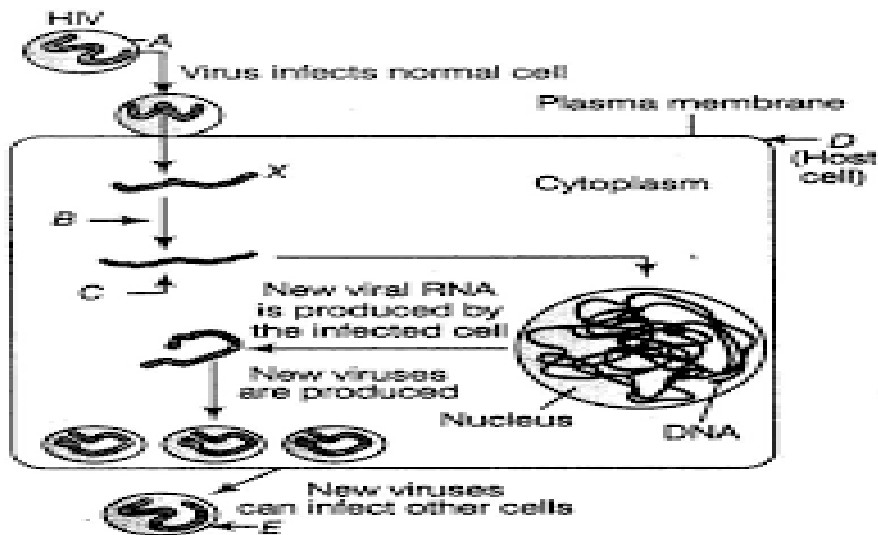
Ans Opium (*Papaver somniferum*), morphine.

2. Which type of mode of reproduction is visible in the following figure also mention in which host of *Plasmodium* does this process take place?



Ans Plasmodium undergoes multiple fission in the liver cells and erythrocytes of human host.

4. Identify and label the X, B and C in the following figure.



Ans X= Viral RNA , B= formation of DNA from RNA by enzyme reverse transcriptase, C= Viral DNA

CHAPTER-10 : MICROBES IN HUMAN WELFARE

MCQ TYPE

1. Greater value of BOD indicates to

- a) Untreated Sewage water b) Fresh water c) Marine Water d) Distilled water

Answer 1 :- (a)

2. Which one of the following alcoholic drink produce without distillation?

- a) Wine b) Rum
c) Whisky d) Brandy

Answer 2:- (a)

3. In Swiss cheese, big holes are made by a

- (a) bacterium producing methane gas
(b) machine
(c) fungus releasing a lot of gases while its metabolic activities
(d) bacterium producing large quantities of carbon dioxide

Answer 3:- (d)

4. During which stage of the purification of the sewage water are microbes used?

- (a) Primary treatment (b) Secondary treatment
(c) Tertiary treatment (d) Both (1) and (2)

Answer 4:- (b)

5. What does a high value of BOD(Biochemical Oxygen Demand) indicate?

- (a) That water is pure
(b) That water is less polluted
(c) That water is highly polluted
(d) That consumption of organic matter by microbes is higher in the water

Answer 5:- (c)

6. This entry in the table is wrongly matched

Option	Name of the Microbe	Product	Purpose
(a)	<i>Monascus purpureus</i>	Statins	Lowers blood cholesterol
(b)	<i>Streptococcus</i>	Streptokinase	Removes clots from blood vessels
(c)	<i>Clostridium butylicum</i>	Lipase	Oil stain removal
(d)	<i>Trichoderma polysporum</i>	Cyclosporin-A	Immunosuppressive drug

Answer 6:- (c)

7. This is a good producer of citric acid

- (a) Aspergillus (b) Clostridium (c) Saccharomyces (d) Pseudomonas

Answer 7:- (a)

8. This is not an example of performing biological control of diseases/pests using microbes

- (a) Trichoderma sp. against some plant pathogens
(b) Nucleopolyhedrovirus against insects and other arthropods
(c) Ladybird beetle against aphids
(d) Bt-cotton to increase yield

Answer 8:- (d)

9. This is chiefly produced by the activity of an anaerobic bacteria on sewage

- (a) Laughing gas (b) Propane (c) Mustard gas (d) Marsh gas

Answer 9:- (d)

10. For the production of ethanol, the most common substrate used in distilleries is

- (a) Soya meal (b) Molasses (c) Ground gram (d) corn meal

Answer 10:- (b)

11. This is not a biofertilizer

- (a) Agrobacterium (b) Nostoc (c) Rhizobium (d) Mycorrhiza

Answer 11:- (a)

12. Carbon dioxide is not released in which of the following processes?

- (a) Lactate fermentation (b) Alcoholic fermentation
(c) Aerobic respiration in animals (d) Aerobic respiration in plants

Answer 12:- (a)

13. Nif gene occurs in:

- (a) Penicillium (b) Rhizobium (c) Aspergillus (d) Streptococcus

Answer 13:- (b)

14. An aerobic & symbiotic nitrogen fixing bacterium is:

- (a) Rhizobium (b) Streptococcus (c) Azotobacter (d) Clostridium

Answer 14:- (a)

15. A free-living aerobic and non-photosynthetic nitrogen fixing bacterium is:

- (a) Anabaena (b) Clostridium (c) Azotobacter (d) Rhizobium

Answer 15:- (c)

Assertion & Reason Type Questions.

- A. If both Assertion & Reason are true, and the reason is the correct explanation of the assertion.
B. If both Assertion & Reason are true, and the reason is the not correct explanation of the assertion.
C. If the Assertion is a true statement, but Reason is false.
D. If both Assertion and Reason are false statements

16. **A: Cyclosporin A is an immunosuppressive medicine.**

R: It stimulates the activation of T-cells and prevents rejections.

Answer 16:- (A)

17. **A: Cheese is one of the oldest food items in which microbes are used.**

R: Different varieties of cheese are known by characteristic texture, flavour and taste.

Answer 17:- (A)

18. **A: The chief component of biogas is CH₄.**

R: Biogas plants are prepared on foreign technology

Answer 18:- (C)

19. **A: Wine and beer are produced by distillation of the fermented broth.**

R: Different types of alcoholic drinks are obtained only by fermentation, always followed by the distillation process

Answer 19:- (D)

20. **A: Baculovirus are species-specific.**

R: It is very common in the root ecosystem and effective against several plant pathogens.

Answer 20:- (C)

21. **Microbes are also used for commercial and industrial production of certain chemicals like organic acid, alcohol and enzymes.**

Examples of acids producers are *Aspergillus niger* (a fungus) of citric acids, *Acetobacter aceti* (a bacterium of acetic acid), *Clostridium butylicum* (a bacterium) of butyric acid and *Lactobacillus* (a bacterium) of lactic acid.

A bioactive molecule, cyclosporin A, that is used as an immunosuppressive agent in organ transplant patients, is produced by the fungus *Trichoderma polysporum*. Statins produced by the yeast *Monascus*

purpureus have been commercialised as blood-cholesterol lowering agents. It acts by competitively inhibiting the enzyme responsible for synthesis of cholesterol.

i) Which of the following is used in detergent formulations & are helpful in removing only oily stains from the laundry?

- a) Lipases b) Proteases c) Pectinases d) Statins

ii) _____ is a clot buster.

- a) Streptokinase b) Cyclosporin c) Monascus purpureus d) Statins

iii) Sara faced myocardial infraction which led to a heart attack, at the time she was rushed to the hospital. Which medicine should have been administered to her at that time?

- a) Cyclosporin A b) Streptokinase c) Monascus purpureus d) Statins

iv) Aspergillus niger is used for production of _____.

- a) acetic acid b) butyric acid c) lactic acid d) citric acid.

v) _____ is used in production of breads & ethanol.

- a) Yeast b) Virus c) Blue green algae d) Spirogyra

Answer 21:- i-(a), ii-(a), iii-(b), iv-(a), v-(a)

22. The Primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structure). While growing these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD of the effluent. BOD refers to the amount of the oxygen that would be consumed if all organic matter in 1 liter of water were oxidized by bacteria. The BOD test measures the rate of oxygen by micro-organisms in a sample of water.

i) BOD stands for:-

- a) Biological Oxygen Demand b) Bio Oxygen Demand
c) Biochemical Oxygen Demand d) Biogeo Oxygen Demand

ii) The greater BOD of waste water, more is its _____

- a) cleanliness b) CO₂ potential c) polluting potential d) water level

iii) The purpose of biological treatment of waste water is to

- a) reduce BOD b) increase BOD c) reduce sedimentation d) increase sedimentation

iv) The masses of bacteria held together by slime and fungal filament to form mesh-like structure are called as

- a) primary sludge b) flocs c) activated sludge d) anaerobic sludge

v) _____ is the first step of sewage treatment.

- a) Precipitation b) Chlorination c) Sedimentation d) Aeration

Answer 22:- i-(c), ii-(c), iii-(a), iv-(b), v-(c)

23. Milk starts to coagulate when Lactic Acid Bacteria (LAB) is added to milk as a starter. Mention two benefits that LAB provides.

Answer 23:-

- 1) LAB checks the growth of disease-causing microbes
- 2) LAB converts milk into curd and also increases nutritional quality by increasing vitamin B₁₂.

24. Give the scientific name of the source organism from which the first antibiotic was produced.

Answer 24:- Penicillium notatum

25. Name a microbe used for statin production. How do statins lower blood cholesterol levels?

Answer 25:- Microbe: *Monascus purpureus* Mechanism: Statins are competitive inhibitors of enzymes required for cholesterol synthesis. Therefore, play role in decreasing cholesterol level in the body.

26. 'Swiss cheese' is characterized by the presence of large holes. Name the bacterium responsible for it.

Answer 26:- *Propionibacterium sharmanii*

27. Name the enzyme which is used as clot buster" to remove blood clot from blood vessels of patients.

Answer 27:- Streptokinase.

28. Name the first antibiotic manufactured & also name its source microorganism.

Answer 28:- Penicillin obtained from *penicillium notatum*.

2 Marks Questions

29. Name two alcoholic drinks produced in each of the following ways.

(i) by distillation and (ii) without distillation.

Answer 29:- (i) Whisky, brandy, rum by distillation

(ii) Wine, beer without distillation

30. Lactic Acid Bacteria (LAB) is commonly used in the conversion of milk into curd.

(Mention any two other functions of LAB that are useful to humans).

Answer 30:- (i) LAB in human intestine synthesizes Vitamin B12.

(ii) LAB in human stomach checks the growth of harmful microbes.

31. How do mycorrhizae function as biofertilisers? Explain with example.

Answer 31:- Mycorrhizae are fungi associated with the roots of plants. Many members of genus *Glomus* form mycorrhiza. These fungal symbiont absorbs water and minerals like phosphorus from the soil and provide them to the plant.

32. What are biofertilisers? A farmer is advised to add a culture of bacterium in the soil before sowing the crop. Name the bacterium in the culture. How is this bacterium useful to the crop?

Answer 32:- Biofertilisers are organisms that enrich the nutrient quality of the soil. *Azotobacter*

/*Azospirillum* (free living) This bacterium fixes atmospheric nitrogen into organic forms, which is used by the plants as nutrient

33. What for Nucleopolyhedroviruses (NPV) are being used nowadays?

Answer 33:- Nucleopolyhedroviruses are being used to kill insects and other arthropod pests of crops. The viruses have no effect on plants and non-target animals. Thus used in biological control of pests

34. How has the discovery of antibiotics helped mankind in the field of medicine?

Answer 34:- Antibiotics have helped mankind in treating most of the deadly bacterial and fungal diseases of humans

35. What is the relationship between BOD and organic matter in sewage?

Answer 35:- The greater the BOD of wastewater more is the amount of organic matter in sewage.

36. Name two gases produced during secondary treatment by sewage.

Answer 36:- 1. Carbon dioxide and

2. Hydrogen sulphide.

37. Expand the 'LAB'. How are LABs beneficial to humans? (Write any two benefits)

Answer 37:- LAB- Lactic Acid Bacteria Benefits:

Found in curd. They improve the nutritional quality of food. Yogurt is prepared from milk by *Lactobacillus*.

38. What is cyclosporin A? What is its importance?

Answer 38 :- Cyclosporin A. It is an eleven-membered cyclic oligopeptide obtained through the fermentative activity of fungus *Trichoderma Polysporum*. Importance. It has antifungal, anti-inflammatory, and immunosuppressive properties. It inhibits the activation of T-cells and therefore prevents rejection reactions in organ transplantation.

39. Your advice is sought to improve the nitrogen content of the soil to be used for the cultivation of a non-leguminous terrestrial crop.

(i) *Recommend two microbes that can enrich the soil with nitrogen.*

(ii) *Why do leguminous crops not require such enrichment of the soil?*

Answer 39 (i) :- *Azospirillum, Azotobacter, Anabaena, Oscillatoria* (Any two)

Answer 39 (ii) :- Leguminous crops do not require such enrichment of the soil because they have a symbiotic association with *Rhizobium* bacteria which traps nitrogen directly from the atmosphere and provides it to the plant and in turn gets food and shelter.

40. Give examples to prove that microbes release gases during metabolism.

Answer 40:- 1. Large holes in 'Swiss Cheese' are due to the production of a large amount of CO₂ by a bacterium named *Propionibacterium sharmanii*.

2. The puffed-up appearance of dough is due to the production of CO₂ gas by yeast, *Saccharomyces cerevisiae*.

3. Methane, H₂S, and CO are produced during microbial digestion of organic compounds in the case of secondary treatment of sewage.

4. The dung of the cattle produces methane gas in the biogas plants.

41. Why is a slurry of cattle dung (gobar) added to bio-wastes in the tank of a gohar gas plant for the generation of biogas?

Answer 41:- Slurry consisting of excreta dung of cattle commonly called gohar is rich in methanogen bacteria. It is used for the generation of biogas. These bacteria called methane bacterium grow anaerobically and break down.

3 Marks.

42. The three microbes are listed below. Name the product produced by each one of them and mention their use.

(i) *Aspergillus niger*

(ii) *Trichoderma polysporum*

(iii) *Monascus Purpureus*

Answer 42:- (i) *Aspergillus niger* produces citric acid. Citric acid is used as a flavoring agent and as a food preservative.

(ii) *Trichoderma Polysporum* produces a bioactive molecule cyclosporin A. It is used as an immunosuppressive agent in organ transplant patients.

(iii) *Monascus Purpureus* produces statins. Statins are capable of competitive inhibition of enzymes required for cholesterol synthesis. Hence, it is used as blood cholesterol-lowering agents.

43. (i) A patient had suffered myocardial infarction and clots were found in his blood vessels. Name a 'clotbuster' that can be used to dissolve clots and the microorganism from which it is obtained. molecular drug is administered to oppose kidney rejection by the body. What is

(ii) A woman had just undergone a kidney transplant. A bioactive the bioactive molecule? Name the microbe from which this is extracted.

(iii) What do doctors prescribe to lower the blood cholesterol level in patients with high blood cholesterol? Name the source organism from which this drug can be obtained.

Answer 43:- (i) Streptokinase- 'Clot buster' can be used to dissolve clots. It is obtained from the bacteria *Streptococcus*

- (ii) The bioactive molecule is Cyclosporin A which is used as an immunosuppressive agent in organ transplantation. It is produced by the fungus *Trichoderma polysporum*.
- (iii) Doctors prescribe Statins to lower blood cholesterol. It is obtained from the fungus *Monascus purpureus*.

44. Draw the well labelled diagram of the Biogas plant.

Answer 44:- Fig 10.8 (Page No-186: Refer NCERT Book).

5 Marks

45. Microbes can be used to decrease the use of chemical fertilizers. Explain how this can be accomplished.

Answer 45:- 1. *Rhizobium* bacteria present in the root nodules of leguminous plants (pea family) forms a symbiotic association and fixes atmospheric nitrogen into organic forms as nitrates/nitrites which are used by the plant as nutrient.

- Free-living bacteria in the soil *Azospirillum* and *Azotobacter* can fix atmospheric nitrogen thus enriching the nitrogen content of the soil.
- Many members of the genus *Glomus* (Fungi) form mycorrhizal symbiotic associations with higher plants. In these, the fungal symbiont absorbs phosphorus from soil and passes it to the plant.

46. Describe the primary and secondary treatment of domestic sewage before it is released for reuse.

Answer 46:- Treatment of domestic sewage. The municipal wastewaters are treated in Effluent Treatment Plant (ETP) prior to disposal in water bodies. It consists of 3 steps: primary, secondary, and tertiary.

- Primary treatment.** It includes physical processes, such as sedimentation, floatation, shredding (fragmenting and filtering). These processes remove most of the large debris.
- Secondary treatment.** It is a biological method. Activated sludge method. Sewage, after primary treatment, is pumped into aeration tanks or oxidation ponds. Here, it is mixed with air and sludge containing algae and bacteria. Bacteria consume organic matter. The process results in the release of CO₂ and the formation of sludge or bio solid. Algae produce oxygen for the bacteria. The water, which is now almost clear of organic matter, is chlorinated to kill microorganisms.
- Tertiary treatment.** It involves removal of nitrates and phosphates. The water, after the above treatment, is then released. It can be reused.

47. Given below is a list of six micro-organisms. State their usefulness to humans.

- Nucleopolyhedrovirus
- Saccharomyces cerevisiae*
- Monascus Purpureus*
- Trichoderma polysporum*.
- Penicillium notatum*
- Propionibacterium sharmanii*.

Answer 47:- Name of Micro-organisms & Uses

- Nucleopolyhedrovirus Used in biocontrol of insects
- Saccharomyces cerevisiae* Bread making
Ethanol making
- Monascus Purpureus*
Produces Statin used as blood cholesterol-lowering agent
- Trichoderma polypore*
Preparation of cyclosporin having antifungal, anti-inflammatory, immuno-suppressive properties
- Penicillium notatum* Production of antibiotic, Penicillin
- Propionibacterium sharmanii* Preparation of large-holed swiss cheese.

48. Explain biological control of pests and plant pathogens with examples.

Answer 48: The very familiar beetle with red and black markings the Ladybird, and Dragonflies are useful to get rid of aphids and mosquitoes, respectively.

The bacterial disease will kill the caterpillars, but leave other insects unharmed. Because of the development of the methods of genetic engineering in the last decade or so, scientists have introduced

B. thuringiensis toxin genes into plants. Such plants are resistant to attack by insect pests. Bt-cotton is one such example which is being cultivated in some states of our country.

Biological control of plant pathogens: A biological control developed for use in the treatment of plant disease is the fungus *Trichoderma*. *Trichoderma* sp. are free-living fungi that are very common in soil and root ecosystems. They are effective biocontrol agents of several plant pathogens.

Baculoviruses are pathogens that attack insects and other arthropods. The majority of baculoviruses used as biological control agents are in the genus *Nucleopolyhedrovirus*. These viruses are excellent candidates for species-specific, narrow spectrum insecticidal applications.

They have been shown to have no negative impacts on plants, mammals, birds, fish, or even on non-target insects. This is especially desirable when beneficial insects are being conserved to aid in an overall IPM (integrated pest management) program, or when an ecologically sensitive area is being treated.

49. How do biofertilizers enrich the soil?

Answer 49: Biofertilizers play a vital role to solve the problems of soil fertility and soil productivity. 1. *Anabaena azollae*, a cyanobacterium, lives in symbiotic association with the free-floating water fern, *Azolla*. The symbiotic system *Azolla-Anabaena* complex is known to contribute 40-60 mg N ha⁻¹ per rice crop. In

addition to this, cyanobacteria add organic matter, secrete growth-promoting substances like auxins and vitamins, mobilize insoluble phosphate, and thus improve the physical and chemical nature of the soil.

2. *Rhizobium Leguminosarum* and *Azospirillum* fix atmospheric nitrogen as nitrates and nitrites. 3. *Mycorrhizae* formed by an association of bacteria and roots of higher plants increase soil fertility.

CHAPTER: 11 BIOTECHNOLOGY: PRINCIPLES AND PROCESSES

KEYPOINTS:

1.	Recombinant DNA	Artificially made DNA strand, formed by the combination of two or more gene sequences
2.	ori	Origin of replication, site from where replication starts
3.	Plasmid	Autonomously replicating circular extrachromosomal DNA found in bacteria
4.	Restriction Enzymes	Enzymes which cuts the DNA at specific sites
5.	Vectors	A vector is usually a piece of DNA that carries a sequence of DNA (gene of interest) and introduces it into a new cell.
6.	Gene Cloning	To produce multiple copies of gene in a host cell
7.	Nucleases	A class of enzymes which breaks the nucleic acids in to small fragment by hydrolysing the sugar phosphate backbone
8.	Exonucleases	They remove nucleotides from the ends of the DNA
9.	Endonucleases	Enzymes that cleave the phosphodiester bond within a polynucleotide chain (DNA)
10.	Palindromic Nucleotide Sequences	A sequence of Base pairs that read same on the two strands when orientation of the reading frame kept the same
11.	DNA Ligase	Joins the DNA from two different sources to make recombinant DNA
12.	Gel Electrophoresis	A technique which is used to separate DNA fragments based on their sizes under electric field.
13.	Selectable Markers	These are the genes which are used to select transformants and recombinants. Eg Antibiotic Resistant genes
14.	Transformants	A cell that has received additional genetic material
15.	Recombinants	cell that contains a combining genetic material with different origins
16.	Lysozyme	Enzyme which breakdown bacterial cell wall
17.	Cellulase	Enzyme which breakdown plant cell wall made of cellulose
18.	Chitinase	Enzyme which breakdown fungal cell wall made of chitin
19.	PCR	Polymerase Chain Reaction used to produce multiple copies of the gene
20.	Recombinant protein	A protein made from the recombinant DNA in a host cell
21.	Bioreactors	A large vessels in which raw materials are biologically converted into specific products
22.	Downstream Processing	A series of processes like separation and purification of the product before it is ready for marketing.

Case Based Question:

Read the passage given below and answer the following questions

1. *When I come to the laboratory of my father, I usually see some plates lying on the tables. These plates contain colonies of **bacteria**. These colonies remind me of a city with many inhabitants. In each bacterium there is a king. He is very long, but skinny. The king has many servants. These are thick and short, almost like balls. My father calls the king **DNA**, and the servants' enzymes . . . My father has discovered a servant who serves as a pair of scissors. If a foreign king invades a bacterium, this servant can cut him in small fragments, but he does not do any harm to his own king.*
—Sylvia (10 years old), daughter of Werner Arber (as quoted in Konforti, 2000)

Swiss microbiologist **Werner Arber** was one of the recipients of the 1978 Nobel Prize in Physiology or **Medicine**, an award he earned for his discovery (with Stuart **Linn**) of restriction enzymes. Arber discovered restriction enzymes while studying a phenomenon known as host-controlled restriction of bacteriophages (also known at the time as host-controlled modification of bacteriophages). Bacteriophages are viral particles that invade bacteria and replicate their own DNA independently of the bacterial chromosomal DNA. Prior to Arber's work, researchers **Salvador Luria** and **Mary Human** had

shown that various phages were host specific, with each phage surviving and flourishing only in one host bacterial strain and growing poorly in others (Luria & Human, 1952). Those phages that grew poorly were said to be "restricted" by their host. Arber wanted to know why. Arber proposed that bacterial cells (in this case, *E. coli*) were able to protect themselves against foreign DNA through some sort of enzymatically catalysed genetic defence mechanism (Arber & Linn, 1969). Specifically, he theorized that only those bacteriophages that had previously been in contact with the same bacterial strain could successfully infect new host cells, and that the previous exposure somehow modified the phage DNA in a way that protected it from restriction. Phages with unmodified DNA, on the other hand, were immediately broken down by enzymes. This occurred because the host cell enzymes recognized these phages as foreign, cleaving their DNA and restricting their growth. Arber further proposed that there were specific sites in the genome at which restriction activities occurred.

(Source: Restriction Enzymes By: Leslie A. Pray, Ph.D. © 2008 Nature Education)

1. 'Servant with scissors' refers to
 - a) Bacteriophages
 - b) Bacterial
 - c) Restriction enzymes
 - d) DNA
2. The growth of the Phages were stopped in the host cell because the enzymes in the bacterial cells
 - a) Restricted the growth of the bacteria by degrading their DNA.
 - b) Hydrolyse the phage DNA
 - c) Cleaves the phage DNA at the specific sites
 - d) All of the above.
3. Bacteriophages refers to the
 - a. Bacteria that kills virus
 - b. Virus that attack bacterial cells
 - c. Viruses
 - d. A special type of DNA found in few bacterial cells
4. Assertion: Restriction endonucleases cut the DNA at the specific sites called restriction sites. Reason: All restriction enzymes have same restriction sites
 - a) Both assertion and reason are true and reason is the correct explanation of assertion
 - b) Both assertion and reason are true but reason is not the correct explanation of assertion
 - c) Assertion is correct but the reason is incorrect
 - d) Both Assertion and reason are incorrect.

Ans: 1- c; 2- c; 3- b; 4- c

Read the passage given below and answer the following questions Polymerase chain

reaction (PCR) is a common laboratory technique used to make many copies (millions or billions) of a particular region of DNA. The key ingredients of a PCR reaction are *Taq* polymerase, primers, template DNA, and nucleotides (dNTPs). The ingredients are assembled in a tube, along with cofactors needed by the enzyme, and are put through repeated cycles of heating and cooling that allow DNA to be synthesized.

The basic steps are:

1. **Denaturation** (96° C): Heat the reaction strongly to separate, or denature, the DNA strands. This provides single-stranded template for the next step.
2. **Annealing** (55- 65°C): Cool the reaction so the primers can bind to their complementary sequences on the single-stranded template DNA.
3. **Extension** (72 °C): Raise the reaction temperatures so *Taq* polymerase extends the primers, synthesizing new strands of DNA.

(Source: Khan Academy)

1. DNA polymerase used in PCR is called *Taq* polymerase because
 - a. It can polymerise DNA at higher temperature
 - b. It polymerises DNA in 3' to 5' direction
 - c. It is isolated from bacterium *Thermus aquaticus*
 - d. All of the above

2. Which of the following is incorrectly matched pair:
 - a. PCR Primers- short pieces of Single stranded DNA
 - b. Extension- 3' to 5'
 - c. Denaturation- Breaks the hydrogen bond to make DNA single stranded
 - d. dNTPs- for the synthesis of DNA strand
3. The results of PCR reactions are usually made visible by
 - a. Gel electrophoresis
 - b. DNA fingerprinting
 - c. Southern blotting
 - d. DNA sequencing
4. Assertion: RT-PCR test is used to detect Corona virus in the given sample. Reason: Corona virus replicates by reverse transcription.
 - a) Both assertion and reason are true and reason is the correct explanation of assertion
 - b) Both assertion and reason are true but reason is not the correct explanation of assertion
 - c) Assertion is correct but the reason is incorrect
 - d) Both Assertion and reason are incorrect.

Ans: 1- c; 2- b ;3- a;4- a

Read the passage given below and answer the following questions:

A researcher is performing an experiment to produce the multiple copies of the gene of interest in a host cell. He used pUC18 plasmid vector to transfer the gene of interest in the host cell. pUC18 is a genetically engineered plasmid, characterized by specific features. The vector contains a gene for Ampicillin resistance and an insert of the bacterial lacZ gene. A polylinker site with a number of restriction enzyme sequences is located within the lacZ gene.

The product of a functional lacZ gene is an enzyme called β -galactosidase, which breaks down a chromogenic substrate called X-GAL(5-bromo-4-chloro-3-indolyl-beta-D-galactopyranoside). Thus, when bacterial cells containing pUC18 plasmids are grown on an agar based medium containing X-GAL, the substrate is broken down. Bacterial cells containing pUC18 plasmids give rise to Blue colonies. He inserted the gene of interest into the polylinker site causes disruption of lacZ gene, which is no longer functional. Recombinant pUC18 plasmids can be identified using lacZ gene as a selectable marker. This is done by growing bacterial cells containing the recombinant plasmid on an agar-based medium containing X- GAL. The disrupted lacZ gene is not expressed, hence, it doesn't code for production of β - galactosidase. Consistently, the bacterial cells with the recombinant cannot break down X- GAL, and give rise to white colonies.

Q1. The role of selectable marker is to

- a. Make the host cell competent.
- b. Show resistance against antibiotics
- c. Select recombinants from non-recombinants
- d. Transform the cell.

Q2. In the above experiment the lacZ gene was disrupted by the insertion of gene of interest, which is further used to select recombinants. This method is known as

- a. Insertional activation
- b. Insertional inactivation
- c. Insertional disruption

- d. Loss of resistance

Q3. The enzyme responsible for the breakdown of X-GAL is β -galactosidase. The cells containing pUC 18 plasmid will produce a colonies because _____ b _____.

- a. Blue colonies, X-GAL is blue in colour
- b. White colonies, β -galactosidase degrades X-GAL
- c. White colonies, β -galactosidase becomes inactive
- d. Blue colonies, β -galactosidase degrades X-GAL

Q4. Assertion: The insertion of gene of interest within the lacZ gene stops the production of the enzyme β -galactosidase.

Reason: The recombinants produce white colonies.

- a) Both assertion and reason are true and reason is the correct explanation of assertion
- b) Both assertion and reason are true but reason is not the correct explanation of assertion
- c) Assertion is correct but the reason is incorrect
- d) Both Assertion and reason are incorrect

Ans: 1- c; 2- b; 3- d; 4- a

Read the passage given below and answer the following questions:

By definition, a bioreactor is a vessel in which a biological reaction or change takes place. The biological systems involved include enzymes, microorganisms, animal cells, plant cells, and tissues. The bioreactor is a place where an optimum external environment is provided to meet the needs of the biological reaction system so that a high yield of the bioprocess is achieved. Obviously, there are complicated interactions between the biological system and the physical and chemical aspects of this process. A variety of bioreactor types and configurations have thus been exploited and developed along with the advances in the understanding of biological systems. In addition, it is necessary to control the bioreactor's operating parameters in order to favor the desired functions of the living cells or enzymes. Dissolved oxygen concentration, pH, temperature, mixing, and supplementation of nutrients all need to be controlled and optimized.

Because of the rapid advances in recombinant DNA technology and genome sequencing, the same product or biological process may be achieved by different biological systems: microorganisms, plant cells, animal cells, or enzymes. With the understanding of the biological system and its requirements on its physical and chemical environment, a proper bioreactor type can be selected.

(Source: Si-jing Wang, Jian-jiang Zhong, in *Bioprocessing for Value-Added Products from Renewable Resources*, 2007)

Q1. The bioreactors are used for

- a. Large scale production of the desired gene product
- b. Growing microbes in laboratories
- c. PCR reactions
- d. Downstream processing

Q2. Which of the following is correctly matched

- a. Stirrer- Maintains temperature
- b. Sampling ports- for adding nutrients

- c. Nutrient medium-nutrition for microbes
- d. pH control system- Oxygen supply.

Q3. Stirred Bioreactors are better because they have

- a. better aeration and mixing properties
- b. foam control system
- c. better temperature and pH control systems
- d. All of the above.

Q4. Assertion: Bioreactors are used for the large scale production of the desired products..

Reason: Bioreactor designing only needs complete information of biological systems.

- a) Both assertion and reason are true and reason is the correct explanation of assertion
- b) Both assertion and reason are true but reason is not the correct explanation of assertion
- c) Assertion is correct but the reason is incorrect
- d) Both Assertion and reason are incorrect.

Ans: 1- a; 2- c; 3- d; 4- c

SHORT ANSWER QUESTIONS

Q1. Which enzyme is commonly called as ‘molecular scissor’ of genetic engineering? Give one example also

Ans: Restriction enzyme. Eg: EcoR1

Q2. Which enzyme you would use to isolate DNA from the fungal cell and why?

Ans: Chitinase, because fungal cell wall is made of chitin which is digested by the enzyme chitinase only.

Q3. Which dye is used to make DNA visible under UV light? Why this dye should be handled very carefully?

Ans: Ethidium Bromide or EtBr. This dye should be handled very carefully because it is carcinogenic in nature.

Q4. What do you mean by direct gene transfer? Suggest one method for this.

Ans: Direct gene transfer means the vectorless gene transfer. Electroporation/microinjection/Gene gun method or biolistic.

Q5. Name the technique used to amplify the DNA? List the steps involved in this.

Ans: Polymerase chain reaction (PCR). The three steps are:

- a. Denaturation
- b. annealing and
- c. Extension

Q6. A researcher added DNA polymerase in the reaction mixture used for PCR to make multiple copies of the DNA. At the end of the reaction he observed that DNA amplification did not occur. What is the reason behind his failure?

Ans: In PCR Taq polymerase enzyme is used for the process of polymerisation because it is a thermostable DNA polymerase and do not get denatured at high temperature used during PCR reaction. He failed because he used DNA polymerase which got denatured during PCR reaction.

Q7. What do you mean by the term ‘competent’ in competent cells? Why the cells made competent?

Ans The term 'competent' means to make the bacterial cell capable of taking up foreign DNA. The cells made competent because DNA is a hydrophilic molecule cannot pass through the cell membrane as its interior is hydrophobic

Q8. Name the methods which are useful to introduce foreign DNA in animal cell and plant cells, respectively.

Answer: Animal cell: Microinjection
Plant cell: Biolistics or gene gun

Q9. *Agrobacterium tumefaciens* is referred to as Natural Genetic Engineer of plant. Why?

Ans *Agrobacterium tumefaciens* is a pathogen to several dicot plants. It can transform normal cell into tumour cell by transferring a piece of DNA called T-DNA. This is called natural Genetic Engineer because gene transfer occurs naturally without involving any human effort.

Q10. What does H, in, d and II refer in the enzyme *Hind II*.

Ans The first letter written in capital denotes the genus of the source organism from which enzyme was isolated H= Haemophilus

The next two letters written in small denotes the species of the source organism from which enzyme was isolated, in= influenza

The letter 'd' refers to the name of the strain of bacteria.

The Roman numerical II denotes the order of discovery of the enzyme from that particular organism.

Q11. Name and explain the technique with which the DNA is forced into (i) a bacterial cell (ii) a plant cell (iii) an animal cell.

Ans. (i) Bacterial Cell: Chemical treatment with a specific concentration of divalent cations such as Calcium, which increases the efficiency with which DNA enters the bacterium through pores in its cell wall. Recombinant DNA can then be forced into such cell by incubating the cells recombinant DNA on ice, followed by placing them briefly at 42°C (Heat Shock) and then putting them on ice.

(ii) Plant Cell: Plant cells are bombarded with high velocity micro-particles of gold and tungsten coated with DNA. This is called Biolistic or gene gun.

(iii) Animal Cell: Recombinant DNA is directly injected into the nucleus of the animal cell. This method is known as microinjection.

Q12. Cloning vectors are used to transfer gene of interest in the host cell in recombinant DNA technology. Mention any three features of vectors that are most suitable for this purpose.

Ans. i) Have origin of replication (Ori)

(ii) Have a selectable marker

(iii) Have at least one recognition site.

Q13. Observe the given sequence of nitrogenous bases on a DNA fragment and answer the following question –

5' –GAATTC – 3'

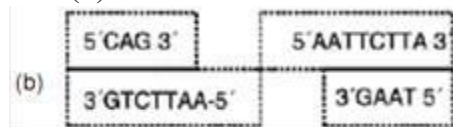
3' –CTTAAG – 5'

(a) Name a restriction enzyme which can recognise this DNA sequence.

(b) Write the sequence after digestion.

(c) Why are the ends generated after digestion called sticky ends?

Ans (a) EcoRI



(c) These are named sticky ends, because they form hydrogen bonds with their complementary cut parts

Q14. 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?

Ans (a) Insertional inactivation

(b) β -galactosidase.

(c) Selection of recombinants due to inactivation of antibiotics resistance requires simultaneous plating on two plates having different antibiotics.

Q15. Enlist the characteristics that must be possessed by a good cloning vector. Ans. The

important properties which a good vector must possess are :-

i) **Size:** - The vector must have small size so that it is easier to purify & isolate.

ii) **Origin of replication:** - This is a sequence of base pairs where replication starts. Any piece of DNA linked to this sequence can be made to replicate within its host cell & thus controls the copy number of linked DNA.

iii) **Selectable Marker:** - A marker is a gene which helps in selecting those host cells which contain the vector & eliminating the non - transformants. Common selectable markers include gene encoding resistance to antibiotics.

iv) **Cloning Sites:** - The vector should have a few or at least one unique recognition site to link the foreign. Presence of a particular recognition site enables the particular restriction enzyme to cut the vector.

Long Answer Questions

1. The development of bioreactors is required to produce large quantities of products.

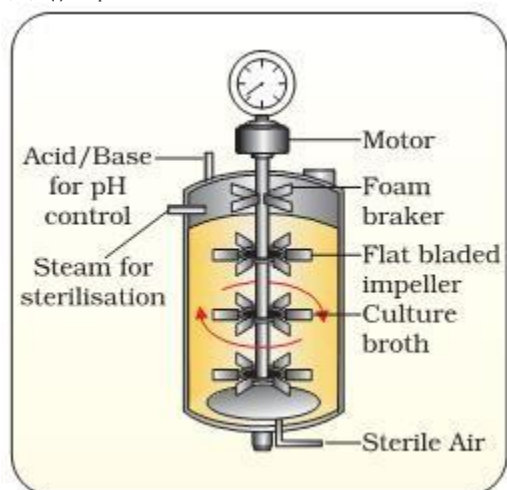
(a) Give optimum growth conditions used in bioreactors.

(b) Draw a well labelled diagram of simple stirred – tank bioreactor.

(c) How does a simple stirred – tank’ bioreactor differ from sparged stirred – tank’ bioreactor?

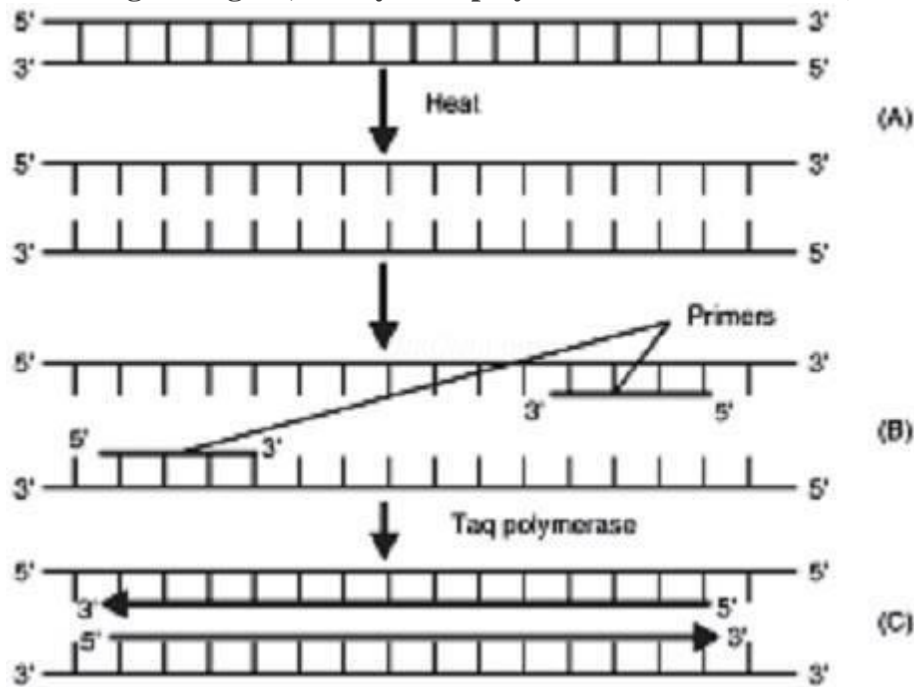
Ans. (i) Temperature, pH, substrates, salts, vitamins and oxygen.

(ii) (a) simple stirred–tank bioreactor



(iii) 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.

2. In the given figure, one cycle of polymerase chain reaction (PCR) is shown-



(a) Name the steps A, B and C.

(b) Give the purpose of each of these steps.

(c) State the advantage of bacterium *Thermus aquaticus* in this process.

(d) Why are primers used in PCR.

Ans. (a) A- Denaturation; B- Annealing; C- Extension

(b) Denaturation – Heat denatures DNA to separate complementary strands
 Annealing: Primers hybridises to the denatured DNA strands

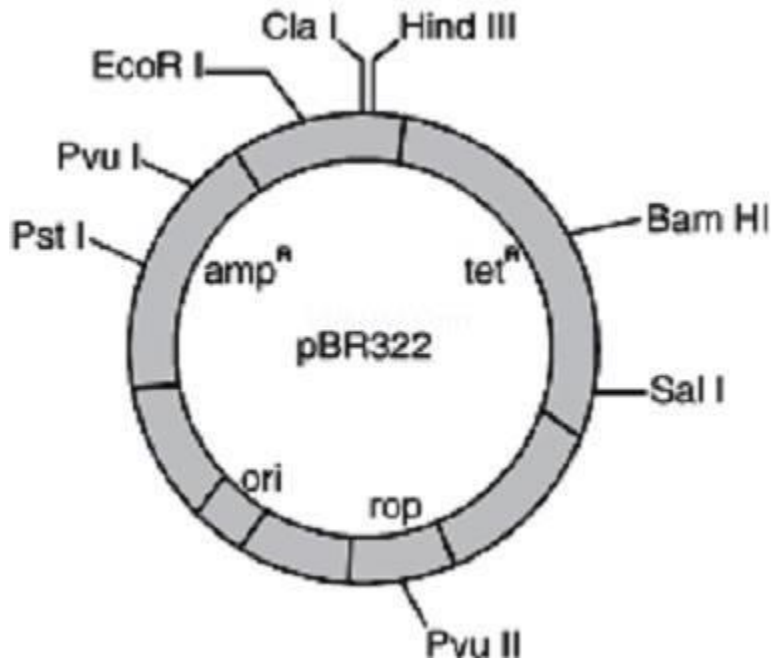
Extension : Extension of primers resulting in synthesis of copies of target DNA

sequence.

(c) Enzyme Tag polymerase is isolated from the bacterium *Thermus aquaticus*. This enzyme induces denaturation of double stranded DNA at high temperature.

(d) Just like human and bacterial DNA polymerase, Taq Polymerase can't initiate the process of polymerisation. It can only extend the existing nucleotide strand. Therefore DNA primers are added in PCR

3. Study the figure of vector pBR322 given below in which foreign DNA is ligated at the Bam H1 site of tetracycline resistance gene.



Answer the following questions :

(a) Mention the function of rop.

(b) What will be the selectable marker for this recombinant plasmid and why?

(c) Explain transformation.

Ans. (a) 'rop' codes for the proteins involved in the replication of plasmid

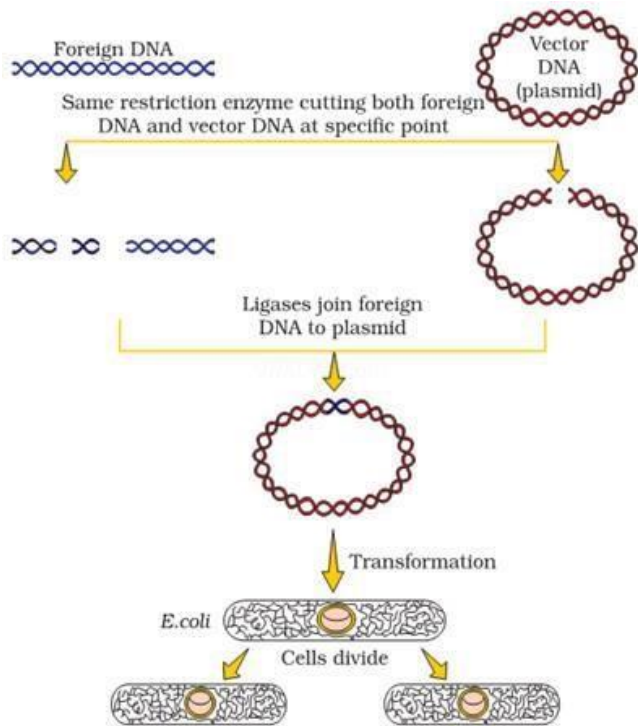
(b) Selectable marker – ampicillin resistance gene. It will help distinguishing transformants from non-transformants after plating them on ampicillin containing medium.

(c) Transformation - It is the phenomenon by which the DNA isolated from one type of cell and introduced into another type and is able to bring about some of the properties of former to the later.

4. Describe the various steps involved in Recombinant DNA technology with the help of a well labelled. Diagram?

Ans. i) Identification of DNA with desirable Genes

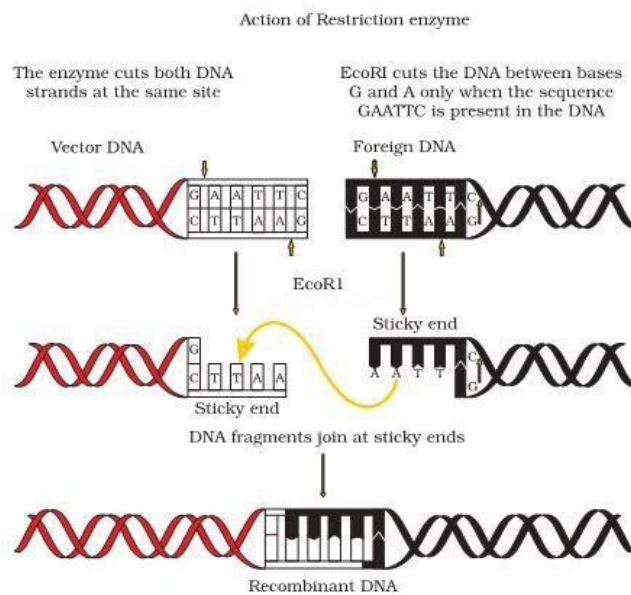
ii) Cutting the gene of interest and vector with the same restriction enzymes so that complimentary ends are formed. Ligase is added to make the recombinant DNA iii) Insertion of Recombinant DNA into host cell :- Recipient cells after making them competent to receive takes up DNA in its surrounding. Recombinant DNA is introduced into suitable host cell by vector - based or vector - less method.



iv) Selection & Screening :- If a recombinant DNA bearing gene for resistance to an antibiotic is transferred into E.coli the host – cell become transformed into ampicillin – resistant cells. Due to this amp gene one is able to select a transformed cell in the presence of ampicillin. This amp resistant gene is called selectable marker. v) Obtaining the foreign Gene product :- After having cloned the gene of interest & having optimized the conditions to induce expression of the target protein, one has to consider producing it on large scale.

6. What are Restriction enzyme? Why do bacteria have these restriction enzymes? Show diagrammatically a restriction enzyme its recognition & the product it produces?

Ans. Restriction enzymes are endonucleases which recognize a specific sequence within DNA and cut the DNA within that sequence at a specific point. In bacteria, these restriction enzymes modify & cut the foreign DNA entering into the bacterial cell & thus, provides immunity to bacterial cell. Name of Restriction enzyme- EcoRI Substrate DNA on which it acts



CHAPTER-12 : BIOTECHNOLOGY AND ITS APPLICATIONS

MULTIPLE CHOICE QUESTIONS

- The process of RNA interference has been used in the development of plants resistant to ____**
A. Insects B. Nematodes C. Fungi D. Viruses Ans- B
Nematodes
- The first ever human hormone produced by recombinant DNA technology is ____**
A. Progesterone B. Insulin C. Estrogen D. Progesterone Ans- B
Insulin
- In Bt cotton, the Bt toxin present in plant tissue as pro-toxin is converted into active toxin due to ____**
A. Acidic pH of the insect gut B. Alkaline pH of the insect gut
C. Presence of conversion factors in insect gut of insect gut D. Action of gut microorganisms Ans- B Alkaline pH
- The first transgenic crop was**
A. Tobacco B. Tomato C. Cotton D. Flax Ans :
Tobacco
- Golden rice is a transgenic crop of future, with one of the following improved traits**
A. Insect resistance B. High Protein content
C. High lysine content D. High Vitamin A content Ans: High Vitamin
A content

ASSERTION REASON QUESTIONS-

- Assertion: The milk of Rosie cow is nutritionally more balanced for infants. Reason- Rosie's milk contains 2.4 g/L of human lactalbumin.
A - Both A and R are true and R is the correct explanation of A
B - Both A and R are true but R is NOT the correct explanation of A C - A is true but R is false.
D - A is false but R is true. E - Both A and R are false. Ans- A
- Assertion: Transgenic animals are used to test the safety of drugs and vaccines before these are administered on humans.
Reason: It is easy and quick to test toxicity of drugs and vaccines on transgenic organisms.
A - Both A and R are true and R is the correct explanation of A
B - Both A and R are true but R is NOT the correct explanation of A C - A is true but R is false.
D - A is false but R is true. E - Both A and R are false. Ans- C
- Assertion: RNAi is a natural method of defence in eukaryotes Reason: RNAi is used to produce nematode resistant tobacco plants
A - Both A and R are true and R is the correct explanation of A
B - Both A and R are true but R is NOT the correct explanation of A C - A is true but R is false.
D - A is false but R is true. E - Both A and R are false. Ans- A
- Assertion: Biopiracy is the practice of commercially exploiting naturally occurring biochemical or genetic material, especially by obtaining patents that restrict its future use, while failing to pay fair compensation to the community from which it originates.
Reason: US patented turmeric and neem which is a case of biopiracy. A - Both A and R are true and R is the correct explanation of A

B · Both A and R are true but R is **NOT** the correct explanation of A.C - A is true but R is false.

D · A is false but R is true.E - Both A and R

are false. Ans- B

5. Assertion: Early detection of diseases caused by mutation in genes, HIV and cancer is possible .Reason: r-DNA technology and its techniques have helped in early molecular diagnosis of genetic diseases, HIV and cancer.

A · Both A and R are true and R is the correct explanation of A

B · Both A and R are true but R is **NOT** the correct explanation of A.C - A is true but R is false.

D · A is false but R is true.E - Both A and R

are false. Ans- A

6. Assertion (A) : Agrobacterium tumefaciens is popular in genetic engineering because the bacterium is associated with the roots of all cereal and pulse crops

Reason (R) : A gene incorporated in the bacterial chromosomal genome gets automatically transferred to the crop with which the bacterium is associated.

A · Both A and R are true and R is the correct explanation of A

B · Both A and R are true but R is **NOT** the correct explanation of A.C - A is true but R is false.

D · A is false but R is true.E - Both A and R

are false. Ans : D

7. Assertion (A) : In recombinant DNA technology, human genes are often transferred into bacteria or yeast.

Reason (R) : Both bacteria and yeast multiply very fast to form huge populations, which express the desired genes

A · Both A and R are true and R is the correct explanation of A

B · Both A and R are true but R is **NOT** the correct explanation of A.C - A is true but R is false.

D · A is false but R is true.E - Both A and R

are false. Ans : A

8. Assertion (A) : GM crops can affect human health by causing allergic reactions.

Reason (R) : Transgenes in commercial crops can endanger native species e.g the Bt toxin gene expressed in pollen might endanger pollinators like honeybees

A · Both A and R are true and R is the correct explanation of A

B · Both A and R are true but R is **NOT** the correct explanation of A.C - A is true but R is false.

D · A is false but R is true. Ans: B

9. Assertion (A): Genetic engineering is also called recombinant DNA technology Reason (R) : It brings about improvement of genetic makeup of an organism.

A · Both A and R are true and R is the correct explanation of A

B · Both A and R are true but R is **NOT** the correct explanation of A.C - A is true but R is false.

D · A is false but R is true. Ans : A

10. Assertion (A) : Bt toxin gene has been cloned from bacteria expressed in plants to provide protections against insect without the use of insecticide.

Reason (R) : Bt toxin is produced from bacterium *Bacillus thuringiensis*.

A - Both A and R are true and R is the correct explanation of A.

B - Both A and R are true but R is NOT the correct explanation of A. C - A is true but R is false.

D - A is false but R is true. Ans : A

CASE BASED QUESTIONS-

1. Read the passage and answer any 4 questions that follow -

Diabetes is a hyperglycemic metabolic disorder resulting from insufficient production of insulin, with consequent metabolic dysfunctions. Of four types and affecting more than 415 million people, it is a forefront public health peril globally.

Escherichia coli remains the best bacterium prototype for rDNA experiments. Cleavage of the signal polypeptide in Islets of Langerhans produced proinsulin yields proinsulin, the enzymatic removal of the link chain in which gives Human insulin (humulin); a 51 amino-acids polypeptide of mass 5808Da. In 1978, humulin was first produced in *Escherichia coli*, eliminating zoonotic cross-transfer/autoimmune-diseases risk. It is also more economical. The manufacturing process can be from separate A and B polypeptide chains, or from proinsulin. An amino acid sequencer manufactures the sequences, which are cloned onto a plasmid. The bacteria are transfected, and placed in fermentation tanks. The insulin molecules are stored in inclusion bodies, and solubilisation (by chemicals and enzymes) and refolding yield the final insulin.

1.1 How was insulin prepared traditionally?

a. From slaughtered hens

b. From slaughtered pigs

c. From slaughtered horses

d. From Slaughtered cattle and pigs

1.2

What are the shortcomings of insulin obtained from slaughtered animals?

a) Insufficient in quantity and contain antibodies which can cause allergy.

b) Insufficient in quantity and contain antigens which can cause allergy.

c) Sufficient in quantity and contain antigens which can cause allergy.

d) None of the above.

1.3 How did Eli Lilly prepared insulin?

a) By tissue culture technique

b) By r-DNA technology

c) By artificial hybridisation

d) By gene therapy

1.4 What is the difference between proinsulin and insulin structurally?

a) No difference

b) Proinsulin has an extra C-peptide which is absent in insulin.

c) Insulin has an extra C-peptide which is absent in proinsulin.

d) Proinsulin in inactive form and insulin is active form.

1.5 How is chain A and chain B of insulin held together?

a) By hydrogen bonds

b) By electrostatic bonds

c) By disulphide bonds

d) By Vander walls forces

Ans-1.1 d) From slaughtered cattle and pigs

1.2 b) Insufficient in quantity and contain antigens which can cause allergy.

1.3 b) By r-DNA technology

1.4 b) Proinsulin has an extra C-peptide which is absent in insulin.

1.5 c) By disulphide bonds

2. Animals with manipulated genetic material (carrying recombinant DNA) are known as transgenic animals. Transgenic technology provides a method to rapidly introduce new genes into animals without cross breeding. It is a powerful technique for studying fundamental problems of mammalian development. Transgenic technology has been developed and found perfect in the laboratory on mice. The three most common gene transfer techniques namely: DNA microinjection, ES-cell mediated and Retrovirus mediated gene transfer are the most important to have enabled to produce transgenic cattle, sheep, goat, pig and other animals. Transgenic animals have the potential of agricultural applications like improved growth rate and carcass composition, improved resistance to disease, increased milk yield, improved wool production and so on. The scientific outlook of right and wrong opinions about transgenic animals is called ethics of transgenic animals. These ethical and animal welfare issues surround transgenic animal technology and be only minimized or avoided through awareness creation about the merit of this technology.
- 2.1 Which option does not indicate that humans are benefitted from transgenic animals?
 a) for study of diseases b) to determine vaccine safety
 c) to test safety of drugs d) to determine the safety of human alpha lactalbumin
- 2.2 Which of the following is a r-DNA vaccine?
 a) Cancer b) cystic fibrosis c) Hepatitis B d) Tuberculosis
- 2.3 Name the vector which is most commonly used to produce transgenic animals
 a) Retrovirus b) Ti plasmid c) YAC d) BAC
- 2.4 Transgenic animals are-
 a) Those animals whose entire genetic makeup is manipulated.
 b) Those animals where a foreign gene is not incorporated
 c) Mice
 d) Those animals in which a foreign gene which is beneficial for mankind is incorporated.
- 2.5 Name the organization set up by Indian Government to check safety of introducing transgenic animals for human services.
 a) WHO b) NBRI c) CDRl d) GEAC

Ans- 2.1 d) to determine the safety of human alpha lactalbumin

2.2 c) Hepatitis B

2.3 a) Retrovirus

2.4 d) Those animals in which a foreign gene which is beneficial for mankind is incorporated.

2.5 d) GEAC

3. Read the following and answer any four questions from 3(i) to 3(v) given below:
 Golden rice was engineered from normal rice by Potrykus and Beyer in the 1990s. The typical golden colour is due to the production of β -carotene a precursor of Vitamin-A. Golden rice differs from its parental strain by the addition of three β -carotene genes. These included two genes from daffodil plant and third from a bacterium. The incorporation of these genes allows the rice plant to modify certain metabolic pathways in its cells to produce β -carotene.
- (i) Due to genetic modification golden rice plants produce and store β -carotene in
 (a) Stem (b) seed (c) leaves (d) all of these.
- (ii) Transfer of genes to produce golden rice is achieved by
 (a) Agrobacterium (b) pBR322 (c) λ -phage (d) gene gun
- (iii) In golden rice two genes were taken from
 (a) Narcissus sp (b) Erwinia (c) *Coryza sativa* (d) None of these

(iv) Golden rice is helpful to fight against disease caused by the deficiency of

- (a) Vitamin B₁₂ (b) Vitamin C (c) Vitamin A (d) Vitamin D

(v) Golden rice was genetically engineered by

- (a) Fire and Mello (b) Potrykus and Beyer (c) Banting and Best (d) Kohler & Milestein

Ans :- 3 (i) – Seed

(ii) Agrobacterium

(iii) Narcissus sp.

(iv) Vitamin A

(v) Potrykus and Beyer

Read the following and answer any four questions from 4(i) to 4(v) given below: Transgenic animals can serve as factories that in some cases, may produce large amount of proteins more efficiently. Transgenic mice have been engineered to express human antibodies by introducing large segment of human DNA encoding human immunoglobulin genes. In transgenic large animals such as cow or sheep proteins of pharmaceutical value can be produced in large quantities in milk which is later purified. Transgenesis can be used to alter many phenotypic properties including growth rate, fat composition, milk production, hair texture, etc.

¶ The production of transgenic animals includes

- (a) identification and separation of desired gene
(b) combining the desired gene with appropriate vector
(c) introduction of vector in cells, tissues or embryos
(d) all of these.

¶ In transgenic animals, i.e., cow and sheep proteins of pharmaceutical value are produced in large quantities in the

- (a) Blood (b) accumulated fat (c) mammary glands (d) none of these.

¶ Mouse is mostly preferred animal for studies on gene transfer because

- A) short oestrous cycle B) long gestation period
C) Short generation time D) Production of one or two offspring per pregnancy

- (a) both (A) and (C) (b) both (A) and (B)
(c) only D (d) both (C) and (D)

(v) Transgenic genes alter many phenotypic properties including

- (a) Growth Rate (b) Fat composition
(c) Milk production (d) All of these

(vi) Assertion (A) : Transgenic mice have been engineered to express human antibodies.

Reason (R) : Large segment of human DNA encoding human immunoglobulin have been transfer to mice.

A - Both A and R are true and R is the correct explanation of A.

B - Both A and R are true but R is NOT the correct explanation of A. C - A is true but R is false.

D - A is false but R is true.

Ans : 4 (i) All of these

- (ii) Mammary gland
- (iii) Short oestrus cycle.
- (iv) Both C and D
- (v) Option A

TOPIC- APPLICATIONS IN AGRICULTURE

1. Name the insect pest that is killed by the products of cryI_{Ac} gene. Explain how the gene makes the plant resistant to the insect pest

Ans - Cotton bollworm is killed by products of cry I_{Ac} gene.

(a) cry gene produces Cry protein in inactive crystalline form. After ingestion by the insect, it becomes active due to the alkaline pH of the gut which solubilise the crystals.

(b) The activated toxin binds to the surface of midgut epithelial cells thus creating pores which causes cell swelling and lysis, leading to death of the insects.

2. (a) Why do the toxic insecticidal proteins secreted by *Bacillus thuringiensis* kill the insect and not the bacteria itself?

(b) Name the specific type of gene that is incorporated in a cotton plant to protect the plant against cotton boll worm infestation.

Ans - (a) The Bt toxin protein exists as inactive protoxins but once an insect ingests the inactive toxin is converted into an active form due to the alkaline pH of the gut which solubilise the crystals. Therefore, it does not kill the bacteria.

(b) cry I_{Ac} / cry II_{Ab}

3. Explain the process of RNA interference.

Ans - RNA interference takes place in all eukaryotic organisms as a method of cellular defence. It involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA.

4. Name the process involved in the production of nematode-resistant tobacco plants, using genetic engineering. Explain the strategy adopted to develop such plants.

Ans - The process involved in the production of nematode-resistant plants is RNA interference or RNAi. Using *Agrobacterium* vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and antisense RNA in the host cells. These two RNA's being complementary to each other are formed a double stranded RNA (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode. The consequence was that the parasite could not survive in a transgenic host expressing specific interfering RNA. The transgenic plant thus protected itself from the parasite.

5. Name the vector used for introducing the nematode specific gene in tobacco plant. Ans- Ti plasmid of *Agrobacterium tumefaciens*

6. a) List any four beneficial effects of GM plants.

Ans - (a) Four beneficial effects of GM plants

- (i) Increased tolerance against abiotic stresses (cold, drought, salt, heat).
- (ii) Reduced reliance on chemical pesticides (pest-resistant crops).
- (iii) Reduced post-harvest losses.
- (iv) Increased efficiency of minerals used by plants (this prevents early exhaustion of fertility of soil).
- (v) Enhanced nutritional value of food, e.g. vitamin 'A' enriched rice (golden rice). (Any four)

TOPIC – APPLICATIONS IN MEDICAL FIELD

7. (a) Name the source from which insulin was extracted earlier. Why is this insulin no more in use by diabetic people?

(b) How did Eli Lilly synthesize the human insulin? Mention one difference between this insulin and the one produced by the human pancreas

Ans – (a) Earlier, insulin was extracted from pancreas of slaughtered cattle and pig. This insulin is not in use as some patients developed allergic reaction to this foreign protein

(b) Eli Lilly prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them separately in plasmids of E. coli to produce A and B chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin. Insulin in human pancreas is synthesized as a pro hormone containing the C peptide which is removed in mature hormone. The r DNA insulin does not contain C peptide and is directly prepared in mature form.

8. (a) Mention the cause and the body system affected by ADA deficiency in humans.

(b) Name the vector used for transferring ADA-DNA into the recipient cells in humans. Name the recipient cells.

(c) Mention a possible permanent cure for a ADA deficiency patient.

(d) Name the deficiency for which first clinical gene therapy was given.

(e) What is gene therapy? Name the first clinical case where it was used.

Ans – (a) The cause is the deletion of gene responsible for producing ADA. The immune system is affected and one suffers from SCID.

(b) A retroviral vector is used, recipient cells are lymphocytes.

(c) A possible permanent cure would be gene therapy. In this, c-DNA coding for ADA enzyme is introduced using retroviral vector in lymphocytes of the patient at early embryonic stage.

(d) Adenosine deaminase (ADA) deficiency.

(e) Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo. Normal functional genes are inserted into an individual's cells and tissues to treat disease.

9. Why is proinsulin so called? How is insulin different from it? Ans – Proinsulin is called so because it is an inactive form of insulin.

Insulin	Proinsulin
1. It is made up of two short polypeptide chains A and B linked by disulphide bridges.	1. Along with the two polypeptide chains in insulin. It contains an extra stretch called C peptide.
2. It is functional.	2. It is non-functional.

10. (a) Suggest any two possible treatments that can be given to a patient exhibiting adenosine deaminase deficiency.

(b) Why do children cured by enzyme-replacement therapy for adenosine deaminase deficiency need periodic treatment?

Ans – (a) (i) Enzymes replacement therapy (in which functional ADA is injected)

(ii) Bone marrow transplantation

(iii) Gene therapy / Culturing the lymphocytes followed by introduction of functional ADA cDNA into it & returning it into the patient's body (Any two)

(b) ERT is not a permanent cure so periodic injections of ADA enzyme are required.

11. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit

periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

(b) Name the ailments the two girls were suffering from?

(c) Why did the treatment provided to girl A required repeated visits?

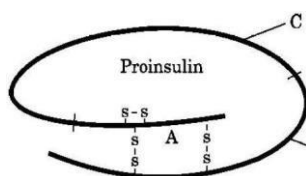
(d) How was the girl B cured permanently?

Ans - (a) Adenosine deaminase (ADA) deficiency

(a) In Enzyme Replacement Therapy functional ADA is introduced to the patient (by injection), this therapy is not completely curative / enzyme can act only for a limited time period

(b) As there is no permanent cure at the age of five.

12. Insulin in the human body is secreted by pancreas as prohormone/proinsulin. The schematic polypeptide structure of proinsulin is given below. This proinsulin needs to undergo processing



before it becomes functional in the body. Answer the questions that follow

(a) State the change the proinsulin undergoes at the time of its processing to become functional.

(b) Name the technique the American company Eli Lilly used for the commercial production of human insulin.

(c) How are the two polypeptides of a functional insulin chemically held together?

Ans (a) C Peptide is removed

(b) r-DNA technology / Recombinant DNA Technology

(c) Disulphide bonds.

TOPIC- TRANSGENIC ANIMALS

13. What are transgenic animals? How was the first transgenic cow found to be more useful than the normal cow, for humans?

Ans - Animals having undergone DNA manipulation (to express an extra / foreign gene) - (Rosie) produced human protein - enriched milk / 2.4 gm protein per litre which contained human alpha - lactalbumin, and was nutritionally more balanced (product) for human babies than natural cow milk.

14. Expand GEAC. Why has the Indian Government set up the organization named GEAC? Give any two reasons. (3)

Ans – GEAC- Genetic Engineering Approval Committee To check the validity of GM crops

To check safety of introduction of GM organism for public services.

15. Explain the role of transgenic animals in (i) Vaccine safety and (ii) Biological products with the help of an example each. (2)

Ans - (i) Vaccine safety- Transgenic mice are developed to test safety of polio vaccine before being used on humans.

(ii) Human protein (α -1-antitrypsin) is used to treat emphysema.

16. Name and briefly explain various techniques for early diagnosis of diseases. (3)

Ans- r-DNA technology, PCR and ELISA are some techniques for early diagnosis of diseases. PCR is used for detection of HIV in suspected AIDS patient, to detect mutations in genes in suspected cancer patients. ELISA is used for detection of antigens of pathogens or antibodies synthesized by body against the pathogen. r-DNA technology can be used to produce clone of mutated gene and then it can be hybridized with probe made of normal gene, followed by its detection using autoradiography.

CHAPTER 13: ORGANISMS AND POPULATION

MCQ

- What is an ecological niche :
 - the ocean
 - an ecologically adapted zone
 - the physical position and functional role of a species within the community
 - formed of all plants and animals living in a lake
- Salinity of the sea measured in parts per thousand (ppt) is:
 - 10–30
 - 30–40
 - 10–15
 - 30–35
- mean annual temperature and mean annual precipitation needed for Formation of tropical forests as a. 18–25°C and 150–400 cm b. 5–15°C and 50–100 cm
c. 30–50°C and 100–150 cm d. 5–15°C and 100–200 cm
- Which type of forest plants controls the light conditions at the ground?
 - Lianas and climbers
 - Shrubs
 - Tall trees
 - Herbs
- What would be the status of the population after some years if a population has more young individuals compared to the older individuals?
 - It will decline
 - It will stabilise
 - It will increase
 - It will first decline and then stabilise
- The density of a population in a given habitat will be decreased by the following :
 - Natality > mortality
 - Immigration > emigration
 - Mortality and emigration
 - Natality and immigration
- Parasitism is an association between two species where a one species is harmed and other is benefitted
 - one species is harmed and other is unaffected
 - one species is benefitted and other is unaffected
 - both the species are harmed.
- Lichens are association of:
 - bacteria and fungus
 - alga and bacterium
 - fungus and alga
 - fungus and virus
- Which of the following is a partial root parasite?
 - Sandal wood
 - Mistletoe
 - Orobanchae
 - Ganoderma
- Which one of the following plants reproduces sexually only once in its life time?
 - Eucalyptus
 - Mango
 - Tomato
 - banana

ASSERTION REASONING TYPE

- ASSERTION: many freshwater animals cannot live for long in sea water REASONING: because of osmotic problems they would face.
 - Both assertion and reasoning are true and reasoning is correct explanation of assertion
 - Both assertion and reasoning are true but reasoning is not correct explanation of assertion
 - Assertion is true but reasoning is false
 - Both assertion and reasoning are false
- ASSERTION: The UV component of the spectrum is harmful to many organisms while not all the colour components of the visible spectrum are available for marine plants living at different depths of the ocean.
REASONING: hence we can say that the spectral quality of solar radiation is also important for life
 - Both assertion and reasoning are true and reasoning is correct explanation of assertion
 - Both assertion and reasoning are true but reasoning is not correct explanation of assertion
 - Assertion is true but reasoning is false
 - Both assertion and reasoning are false
- ASSERTION: If a predator is too efficient and overexploits its prey, then the prey might become extinct and following it, the predator will also become extinct for lack of food. REASONING: This is the reason why predators in nature are „prudent“.
 - Both assertion and reasoning are true and reasoning is correct explanation of assertion
 - Both assertion and reasoning are true but reasoning is not correct explanation of assertion
 - Assertion is true but reasoning is false

d. Both assertion and reasoning are false

14. **ASSERTION:** Mammals from colder climates generally have shorter ears and limbs **REASONING:** This adaptation helps them to minimise heat loss

- a. Both assertion and reasoning are true and reasoning is correct explanation of assertion
- b. Both assertion and reasoning are true but reasoning is not correct explanation of assertion
- c. Assertion is true but reasoning is false
- d. Both assertion and reasoning are false

15. **ASSERTION:** Predators also help in maintaining species diversity in a community,

REASONING: they do so by reducing the intensity of competition among competing prey species.

- a. Both assertion and reasoning are true and reasoning is correct explanation of assertion
- b. Both assertion and reasoning are true but reasoning is not correct explanation of assertion
- c. Assertion is true but reasoning is false
- d. Both assertion and reasoning are false

(1) Mark questions: VSA

16. Define Homeostasis.

Ans: It is the process by which the organism should try to maintain the constancy of its internal environment despite varying external environmental conditions.

17. What is population ecology?

Ans: Population ecology is an important area which links ecology to population genetics and evolution.

18. What do you understand by population density?

Ans: It is the size of population in any given area at given time designated as N.

19. Write the formula of calculating population density in reference to time. Ans: $N_{t+1} = N_t + [(B + I) - (D + E)]$

20. State exponential growth model.

Ans: When resources in the habitat are unlimited, each species has the ability to realise fully its innate potential to grow in number, as Darwin observed while developing his theory of natural selection. Then the population grows in an exponential or geometric fashion.

21. What does 'intrinsic rate of natural increase' signify?

Ans: It is a very important parameter chosen for assessing impacts of any biotic or abiotic factor on population growth.

22. What do you understand by nature's carrying capacity [K]?

Ans: In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible.

23. What is camouflage?

Ans: It is a process by which some species of insects and frogs are cryptically coloured (*camouflaged*) to avoid being detected easily by the predator.

24. Define competition.

Ans: Competition is best defined as a process in which the fitness of one species (measured in terms of its r , the intrinsic rate of increase) is significantly lower in the presence of another species.

25. State Gause's 'Competitive Exclusion Principle'.

Ans: Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.

26. What is resource partitioning?

Ans: If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns.

27. What is commensalism?

Ans: This is the interaction in which one species benefits and the other is neither harmed nor benefited.

28. Define population.

Ans: A population is a group of individuals of a given species sharing or competing for similar resources in a defined geographical area.

(2) Marks questions

29. What is the significance of temperature to living organisms?

Ans: It affects the kinetics of enzymes and through it the metabolic activity and other physiological functions of the organism.

30. How the levels of thermal tolerance of different species determine to a large extent their geographical distribution? Ans: A few organisms can tolerate and thrive in a wide range of temperatures (they are called *eurythermal*), but a vast majority of them are restricted to a narrow range of temperatures (such organisms are called *stenothermal*).

31. List different ways by which organisms try to maintain their homeostasis. Ans: Regulate, Conform, Migrate, Suspend.

32. How do kangaroo rat in North American deserts is capable of meeting all its water requirements?

Ans: In the absence of an external source of water, the kangaroo rat in North American deserts is capable of meeting all its water requirements through its internal fat oxidation (in which water is a by-product). It also has the ability to concentrate its urine so that minimal volume of water is used to remove excretory products.

33. Name four population attributes.

Ans: sex ratio, age distribution, birth rate, death rate.

34. Name four basic processes which cause fluctuations in population density in a given habitat during a given period. Ans: Natality, Mortality, Immigration, Emigration.

35. Name one animal and one plant which breed only once in their lifetime. Ans: Animal- Pacific salmon fish

Plant- Bamboo

36. What is 'competitive release'?

Ans: A species whose distribution is restricted to a small geographical area because of the presence of a competitively superior species, is found to expand its distributional range dramatically when the competing species is experimentally removed.

37. Explain mutualism in *mycorrhizae*.

Ans: the *mycorrhizae* are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates.

3 MARKS QUESTIONS

38. What role does light play for animals?

Ans: For many animals light is important in that they use the diurnal and seasonal variations in light intensity and duration (photoperiod) as cues for timing their foraging reproductive and migratory activities.

39. Explain the process of migration with suitable example.

Ans: The organism can move away temporarily from the stressful habitat to a more hospitable area and return when stressful period is over. Many animals, particularly birds, during winter undertake long-distance migrations to more hospitable areas. Every winter the famous Keolado National Park (Bharatpur) in Rajasthan host thousands of migratory birds coming from Siberia and other extremely cold northern regions.

40. Write the integral form of the exponential growth equation.

Ans: $N_t = N_0 e^{rt}$
 where
 N_t = Population density after time t N_0 = Population density at time zero
 r = intrinsic rate of natural increase
 e = the base of natural logarithms (2.71828)

41. What do you understand by co-evolution in parasitism?

Ans: Many parasites have evolved to be host-specific (they can parasitise only a single species of host) in such a way that both host and the parasite tend to co-evolve; that is, if the host evolves special mechanisms for rejecting or resisting the parasite, the parasite has to evolve mechanisms to counteract and neutralise them, in order to be successful with the same host species.

42. In accordance with their life styles, which special adaptations parasites evolved?

Ans: In accordance with their life styles, parasites evolved special adaptations such as the loss of unnecessary sense organs, presence of adhesive organs or suckers to cling on to the host, loss of digestive system and high reproductive capacity.

5 MARKS QUESTIONS

43. How soil affects the type of animals in any particular geographic area?

Ans: Various characteristics of the soil such as soil composition, grain size and aggregation determine the percolation and water holding capacity of the soils. These characteristics along with parameters such as pH, mineral composition and topography determine to a large extent the vegetation in any area. This in turn dictates the type of animals that can be supported.

44. How do mammals regulate their body temperature to maintain homeostasis?

Ans: We maintain a constant body temperature of 37°C. In summer, when outside temperature is more than our body temperature, we sweat profusely. The resulting evaporative cooling similar to what happens with a desert cooler in operation, brings down the body temperature. In winter when the temperature is much lower than 37°C, we start to shiver, a kind of exercise which produces heat and raises the body temperature.

45. Considering the benefits of a constant internal environment to the organism, why conformers had not evolved to become regulators?

Ans: Thermoregulation is energetically expensive for many organisms. This is particularly true for small animals like shrews and humming birds. Heat loss or heat gain is a function of surface area. Since small animals have a larger surface area relative to their volume, they tend to lose body heat very fast when it is cold outside, then they have to expend much energy to generate body heat through metabolism. During the course of evolution, the costs and benefits of maintaining a constant internal environment are taken into consideration. Some species have evolved the ability to regulate, but only over a limited range of environmental conditions, beyond which they simply conform.

46. Read the following paragraph and answer the questions:

In bacteria, fungi and lower plants, various kinds of thickwalled spores are formed which help them to survive unfavourable conditions - these germinate on availability of suitable environment. In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal - they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of 'dormancy'. In animals, the organism, if unable to migrate, might avoid the stress by escaping in time. The familiar case of bears going into hibernation during winter is an example of escape in time. Some snails and fish go into aestivation to avoid summer-related problems-heat and desiccation. Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development.

Explain following terms with example:

- a) Sporulation
- b) Dormancy
- c) Hibernation
- d) Aestivation
- e) Diapause

Ans: a) In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal - they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of 'dormancy'.

- b) In animals, the organism, if unable to migrate, might avoid the stress by escaping in time. The familiar case of bears going into *hibernation* during winter is an example of escape in time.
- c) Some Snails and fish go into *aestivation* to avoid summer—related problems—heat and desiccation.
- d) Under unfavourable conditions many zooplankton species in lakes and ponds are known to enter *diapause*, a stage of suspended development.

47. Read carefully following case and answer the questions:

Some organisms possess adaptations that are physiological which allow them to respond quickly to a stressful situation. If you had ever been to any high altitude place (>3500m Rohtang Pass near Manali and Leh you must have experienced what is called altitude sickness. Its symptoms include nausea, fatigue and heart palpitations. This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen. But, gradually you get acclimatised and stop experiencing altitude sickness. How did your body solve this problem? The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of hemoglobin and by increasing breathing rate.

a) What is Altitude sickness?

Ans : At high altitude place (>3500m Rohtang Pass near Manali and Leh people experience *altitude sickness*. Its symptoms include nausea, fatigue and heart palpitations. This is because in the low atmospheric pressure of high altitudes, the body does not get enough oxygen.

b) How do people get acclimatised to it?

Ans: Gradually people get acclimatised and stop experiencing altitude sickness. The body compensates low oxygen availability by increasing red blood cell production, decreasing the binding affinity of haemoglobin and by increasing breathing rate.

48. Illustrate age pyramid.

Ans: A population at any given time is composed of individuals of different ages. If the age distribution (per cent individuals of a given age or age group) is plotted for the population, the resulting structure is called an age pyramid. For human population, the age pyramids generally show age distribution of males and females in a diagram. The shape of the pyramids reflects the growth status of the population - (a) whether it is growing (b) stable or (c) declining (fig 13.4)

49. What is Verhulst-Pearl Logistic Growth?

Ans: A population growing in a habitat with limited resources show initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity. A plot of N in relation to time (t) results in a sigmoid curve. This type of population growth is called *Verhulst-Pearl Logistic Growth* (Figure 13.6) and is described by the following equation:

$$\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$$

Where N = Population density at time t
r = Intrinsic rate of natural increase

K = Carrying capacity

50. How do The Mediterranean orchids *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee?

Ans: The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee. One petal of its flower bears an uncanny resemblance to the female of the bee in size, colour and markings. The male bee is attracted to what it perceives as a female, 'pseudocopulates' with the flower, and during that process is dusted with pollen from the flower. When this same bee 'pseudocopulates' with another flower, it transfers pollen to it and thus, pollinates the flower.

CHAPTER-15: BIODIVERSITY AND ITS CONSERVATION

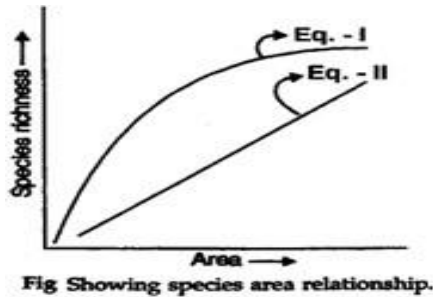
MCQ Type Questions

- The most important cause of loss of biodiversity today is
 - habitat loss and fragmentation
 - over-exploitation
 - alien species invasions
 - co-extinctions
- The Earth Summit was held in Rio de Janeiro in:
 - 1987
 - 1990
 - 1992
 - 2002
- When a threatened plant needs urgent measures to save it from extinction, the desirable approach is
 - in-situ conservation
 - ex-situ conservation
 - cryopreservation
 - bio preservation
- Loss of biodiversity may lead to all except:
 - decline in plant production
 - increased resistance to environmental perturbation
 - increased variability in water use
 - increased variability in pest and disease cycle
- The main difference between "Sixth Extinction" and the previous five extinctions is that the sixth extinction:
 - is mainly occurring on islands
 - is mainly affecting plants
 - is occurring at a faster rate
 - does not involve human activities
- The relation between species richness and area for a wide variety of taxa on a logarithmic scale is a:
 - rectangular hyperbola
 - straight line
 - sigmoid curve
 - sine curve
- The hot spots of biodiversity conservation are characterized by:
 - High endemism and high threat of extinction
 - Low endemism and high threat of extinction
 - High endemism and low threat of extinction
 - Low endemism and low threat of extinction
- Alexander von Humboldt described for the first time
 - ecological biodiversity
 - law of limiting factor
 - species area relationships
 - population growth equation
- According to Robert May, the global species diversity is about:
 - 20 Million
 - 50 Million
 - 7 Million
 - 1.5 Million
- What is common to the techniques (i) in vitro fertilisation, (ii) Cryo preservation and (iii) tissue culture?
 - All are in situ conservation methods
 - All are ex situ conservation methods
 - All require ultra modern equipment and large space
 - All are methods of conservation of extinct organisms
- Which of the following forests is known as the 'lungs of the planet Earth'?
 - Taiga forest
 - Tundra forest
 - Amazon rain forest
 - Rain forests of North East India
- Which one of the following is related to Ex-situ conservation of threatened animals and plants?
 - Wildlife Safari parks
 - Biodiversity hotspots
 - Amazon rainforest
 - Himalayan region
- How many hotspots of biodiversity in the world have been identified till date by Norman Myers?
 - 17
 - 34
 - 25
 - 43
- Red List contains data or information on
 - all economically important plants
 - plants whose products are in international trade
 - threatened species
 - marine vertebrates only
- The species confined to a particular region and not found elsewhere is termed as
 - keystone
 - alien
 - endemic
 - rare
- Cryopreservation of gametes of threatened species in viable and fertile condition can be referred to as
 - in situ conservation of biodiversity
 - advanced ex situ conservation of biodiversity
 - in situ conservation by sacred groves
 - in situ cryo-conservation of biodiversity
- Which one of the following is not observed in biodiversity hot spots?
 - Endemism
 - Accelerated species loss
 - Lesser interspecific competition
 - Species richness
- World Summit on Sustainable Development (2002) was held in
 - Brazil
 - Argentina
 - Sweden
 - South Africa
- Which of the following is considered a hot-spot of biodiversity in India?
 - Western ghats
 - Indo-Gangetic plain
 - Eastern ghats
 - Aravali hills
- Sacred forests are those that?
 - have rich growth of plants Used for worship by the people in the region
 - are protected by tribal communities due to religious sanctity accorded to them
 - have not been discovered humans
 - none of the above

19. Which of the following is best method of germplasm conservation?
 a) Herbarium b) Botanical garden c) Seed bank d) Zoological park
20. India is one of the twelve megadiversity countries with _____ of genetic resources of the world. a) 12.1% b) 18.1% c) 38.1% d) 8.1%

Short Answer Type Questions

1. Expand the following abbreviations
 1. ICFRE 2. IUCN 3. UNEP 4. WWF
2. The great German naturalist and geographer Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit. In fact, relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.



Now find out correct equations shown in the graph

Given below are three statements (A-E) each with one or two blanks. Select the option which correctly fills up the blanks. Statements

- A. The tropics (between _____ I _____) harbour more species than temperate and polar regions
 B. For example, Columbia situated near _____ II _____, has about 1400 species of birds, while New York (41°N) has 105 species, Greenland (71°N) has about 56 species and India (in the equator region) has _____ III _____ species
 C. The number of species of vascular plants in tropics is about _____ IV _____ times more of that of temperate forests
 D. The _____ V _____ rain forest in Brazil, South America has the greatest biodiversity on earth
 E. Since the origin of life on earth and evolution, there have been five episodes of mass extinction, but the current rate of extinction (6 mass extinction - due to human activities) is VI times faster than them, due to human activities:

Options:

- (1) I - 0°N to 90°S, II - equator, III - 1200, IV - five, V - Amazonian, VI - 100 - 1000
 (2) I - 23.5°N to 23.5°S, II - equator, III - 10000, IV - ten, V - Amazonian, VI - 100 - 1000
 (3) I - 23.5°N to 23.5°S, II - equator, III - 1200, IV - ten, V - Amazonian, VI - 100 - 1000
 (4) I - 23.5°N to 23.5°S, II - equator, III - 1200, IV - ten, V - Amazonian, VI - 100 - 10000

Short Answer Type Questions

1. There are about 20,000 species of ants, 3,00,000 species of beetles and 28,000 species of fishes in the world.
 a. Which organization is dealing with the population of organisms in the world?
 b. What are the causes of biodiversity losses?
2. Anil said: -Mosquitoes are harmful, Snakes are poisonous, and Insects damage crops. It is high time to destroy all these organisms for the welfare of human beings. ||
 a. Can you agree with this statement?
 b. As a biology student, how can you convince this person about the importance of each and every organism in the nature?
3. Amazonian rain forests have the greatest biodiversity on earth. Give 3 hypotheses to explain the reason for this.
4. -The biological wealth of our planet has been declining rapidly and the accusing finger is clearly pointing to human activities. ||
 a. Mention any two human activities leading to the loss of biodiversity.
 b. Mention the different ways to conserve biodiversity.
5. Introduction of exotic species is one of the major threats of biodiversity. Cite any two examples.

6. Classify the following words into two categories and give suitable titles: Genetic resource centres, National parks, Botanical gardens, Sanctuaries, Biosphere reserves, Gene banks, Cultural landscapes, Zoological parks, Natural monuments, Sacred forests.

Case Based Question

1. Read the following and answer any four questions given below:

Non-native or alien species are often introduced inadvertently for their economic and other uses. They often become invasive and drive away the local species. Exotic species have proved harmful to both aquatic and terrestrial ecosystems. For example, water hyacinth (*Eichhornia crassipes*) was introduced in Indian waters to reduce pollution. It was clogged water bodies including wetlands at many places resulting in death of several aquatic plants and animals.

- (i) Island water ecosystem are the most vulnerable due to
 (a) small size (b) small number of species
 (c) increases reproductive capacity (d) both (a) and (b).
- (ii) Which of the following is not an alien species?
 (a) *Lantana camara* (b) *Periplaneta americana*
 (c) Nile Perch (d) Yucca moth (iii) Second

major cause of species extinction is

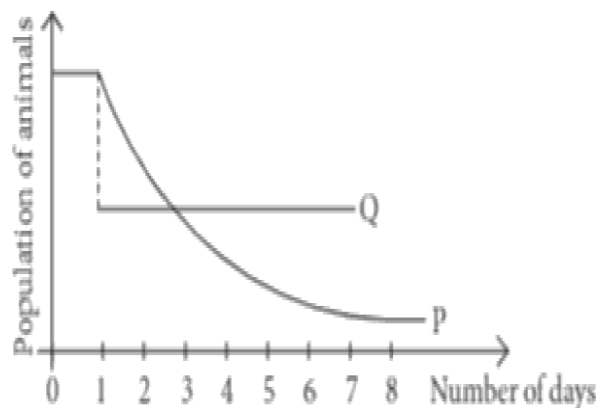
- (a) habitat loss and fragmentation (b) over exploitation
 (c) alien species invasion (d) co-extinction.

- (iv) **Assertion** : *Eichhornia crassipes* drains off oxygen from water and can be seen growing in standing water.

Reason : *Eichhornia crassipes* is an indigenous species of India.

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
 (c) Assertion is true but reason is false.
 (d) Both assertion and reason are false.

- (v) The population of species P in a certain community was constant until a population species Q from a distant land was subsequently introduced into that community. The interaction between the two populations is reflected in the graph below.



What could be the possible reason for the decrease in the population of species P over a number of days?

- (a) Species Q is a predator of species P,
 (b) Species Q is a prey species which wiped out the population of species P.
 (c) Species P and Q compete for space but feeds on different food.
 (d) None of these.

2. Read the following and answer any four questions given below:

IUCN maintains a Red Data book or Red List which is a catalogue of taxa facing risk of extinction. The IUCN Red List (2004) documents the extinction of 784 species in the last 500 years. Some examples of recent extinctions include the dodo, quagga, thylacine and Steller's sea cow. The last twenty years alone have witnessed the disappearance of 27 species. Red List has eight categories of species.

- (i) Dodo, an extinct taxon, belongs to which country?
 (a) Mauritius (b) Africa (c) Australia (d) Russia
- (ii) To which of the following categories of IUCN, *Berberis nilghiriensis* belongs?
 (a) extinct (b) Extinct and wild (c) Endangered (d) Critically endangered
- (iii) Steller's sea cow and passenger pigeon became extinct due to
 (a) alien species invasion (b) over-exploitation (c) coextinctions (d) intensive agriculture
- (iv) Bai Javan and Caspian are
 (a) species of tiger (b) species of cheetah
 (c) subspecies of cheetah (d) subspecies of tiger.
- (v) Select the correct term for the following definitions (i, ii, iii, iv)
- (a) The taxon is liable to become extinct if not allowed to realise its full biotic potential by providing protection from exotic species/human exploitation/habitat deterioration/depletion of food.
 (b) The taxon has been completely eliminated or died out from earth, e.g., Dodo.
 (c) The taxon is facing a high risk of extinction in the wild in the near future due to decrease in its habitat, excessive predation or poaching.
 (d) They are species with naturally small populations, either localised or thinly scattered, which are always at risk from pests/pathogens/predators/exotic species.

	(i)	(ii)	(iii)	(iv)
(a)	Threatened	Extinct	Endangered	Rare
(b)	Endangered	Extinct	Threatened	Rare
(c)	Extinct	Rare	Threatened	Endangered
(d)	Threatened	Extinct	Rare	Endangered

3. Read the follows and answer any four questions given below:

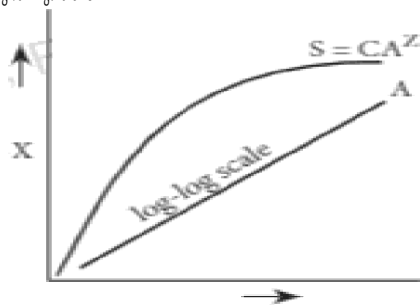
Excessive exploitation of species, whether a plant or animal reduces the size of its population so it becomes vulnerable to extinction. Such as Dodo and passenger pigeon have become extinct due to over exploitation by humans. Thus the world is facing accelerated rates of species extinctions, largely due to human interference.

- (i) which of the following cause of biodiversity loss is not included in evil quartet ?
 (a) Coextinction (b) Pollution
 (c) Alien species invasion (d) Habitat loss and fragmentation
- (ii) Identify the species that use become extinct due to over exploitation
 (a) Stellar sea cow (b) tweek moth (c) *Blatta orientalis* (d) Nile Perch
- (iii) Factors which make species susceptible to extinction are
 (a) large population size (b) lack of genetic variability
 (c) lower status of trophic level (d) ability to switch over to alternate foods.
- (iv) **Assertion** : Pollution reduces species biodiversity.
Reason : Spill over of oil in sea causes death of several marine animals.
- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
 (c) Assertion is true but reason is false.
 (d) Both assertion and reason are false.
- (v) _____ is the first major cause of species extinction.
 (a) Co extinction (b) Over exploitation (c) Habitat destruction (d) Alien species invasion

4. Read the follows and answer any four questions given below:

Within a region, species richness increases with increasing explored area, but only upto a limit. The give Figure explains this relationship.

(i) What does the given figure show?



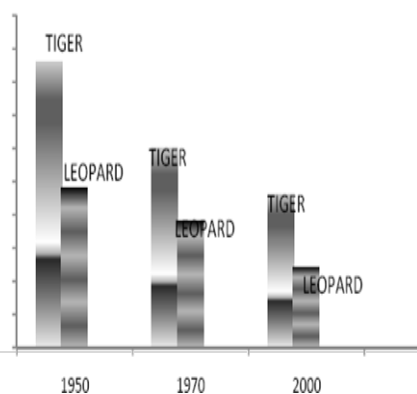
- (a) Rivet-popper hypothesis
 (b) Species-area relationship
 (c) Proportionate number of species of major taxa
 (d) n-ecological diversity
- (ii) Equation for relationship (A) between species richness and area is
 (a) $\log S = \log C + Z \log A$
 (b) $\log C = \log S + Z \log A$
 (c) $Z \log A = \log S + \log C$
 (d) $\log S = \log C + \log A$
- (iii) What is the value of slope of line or regression coefficient Z for frugivorous birds?
 (a) 0.1-0.2
 (b) 1.15
 (c) 0.01-0.1
 (d) 0.6-1.2
- (iv) The shape of curve for relationship between species richness and areas for wide variety of taxa is
 (a) straight line
 (b) parabola
 (c) rectangular hyperbola
 (d) bell shaped
- (v) Who gave this concept of increase in species richness with increasing offered area?
 (a) Humboldt
 (b) Odum
 (c) Edward Wilson
 (d) Paul Ehrlich

5. This is a board seen in front of a national park.



- a. Evaluate the quotation in the board and state your opinion.
 b. Write any four reasons for extinction of animals.
 c. Name three animals extinct recently.
 d. What is the significance of IUCN red list?

6. The given bar diagram shows the population of Asiatic leopard and tiger for the last 50 years in India



Analyse the figure, whether the population of tiger and leopard increasing or decreasing. Find reason.

- (a) Does the decreasing population of the organisms affect the stability of the ecosystem? If yes state how?
- (b) Suggest measures for protecting the population of these organisms.

ASSERTION & REASON

For question numbers 1-10, two **statements are given-cue labelled Assertion and the other labelled Reason**. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of assertion.
- (c) Assertion is true but reason is false.
- (d) Both assertion and reason are false.

1. **Assertion:** The rate of extinction of organisms have increased in recent years.
Reason: Human activities like deforestation, industrialisation, etc, have destroyed the natural habitat of plants and animals.
2. **Assertion:-** Species diversity **decreases** as we ascend towards high mountains.
Reason . Due to drop in temperature, no seasonal variability occurs in high mountains
3. **Assertion:-** Communities with more species tend to be more stable than those with less species.
Reason : Communities with more species is not able to resist occasional disturbances
4. **Assertion:** Dodo, Passenger pigeon, Steller's sea cow have become extinct due to over exploitation. **Reason:** Excessive exploitation of a species, whether animal or plants reduces size of its population so that it becomes vulnerable to extinction.
5. **Assertion** • Maximum biodiversity occurs in temperate areas.
Reason: Temperate areas have favorable conditions for speciation and for supporting variety and number of organisms.
6. **Assertion:** The introduction of Nile perch in Lake Victoria caused cichlids to become extinct.
Reason: Nile perch is an indigenous species of East Africa
7. **Assertion** • Coral reefs are found in temperate forests
Reason: Minimum diversity of biota are found in the reefs
8. **Assertion.** • Many endemic species are seen to flourish in sacred forests.
Reason • Sacred forests are undisturbed forest patches and biodiversity rich areas
9. **Assertion:** Buffer zone surrounds the core area and limited human activities like resource use strategies, research and education are allowed here.
Reason • There is no biotic interference except in buffer zone.
10. **Assertion** • Alpha diversity refers to species diversity present in a given community or habitat. **Reason:** Alpha diversity is expressed by species richness and species evenness in a community or habitat.