CONTENTS

CHAPTER 1

REPRODUCTION IN ORGANISMS

POINTS TO REMEMBER

Bulbils : These are small, fleshy buds which develop into new plants as in *Agave.*

Clone : A group of organism derived from a single individual and hence morphologically and genetically similar.

Embryogenesis : The process of development of embryo from zygote.

Gametogenesis: The process of formation of male and female gametes.

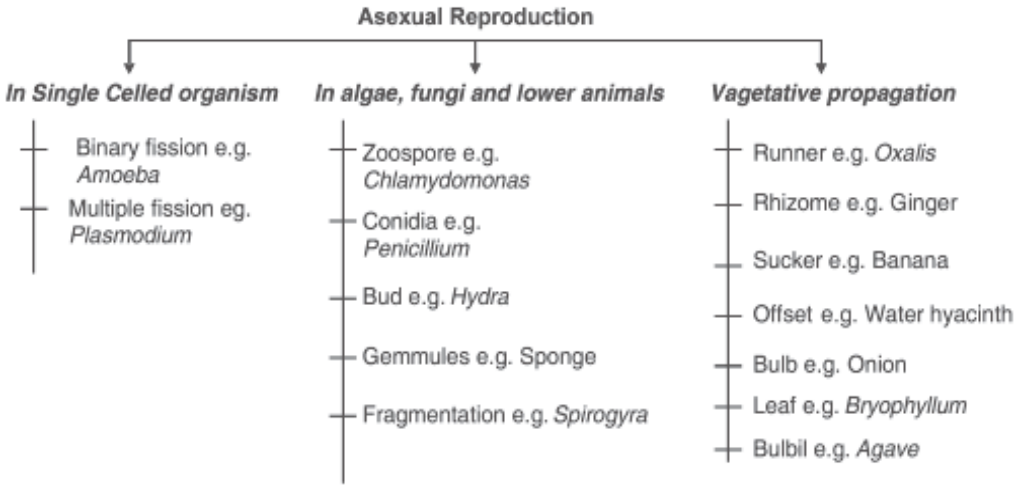
Isogamete : One of a pair of conjugating gametes.

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

Meiocytes : These are specialized cells of diploid organisms which undergo meiosis.

Pericarp : It is the protective covering of fruit, may be divided into epicarp, mesocarp and endocarp.

Parthenogenesis : Development of an egg into an embryo without fertilisation.



Gamete Transfer

1. **In Algae, Bryophytes and Pteridophytes :** The male and female gametes are flagellated and motile, need a medium (water) to reach the egg.
2. In seed Plants : Pollen grains are transferred to stigma of flower of same species by various agents.
3. **In animals :**
   (a) By Copulation – e.g., Reptiles, Birds and Mammals.
   (b) By External medium – e.g., Fishes and Amphibians.

QUESTIONS

VSA (1 MARKS)

1. Offsprings produced by asexual reproduction are referred to as clones. Why?
2. Name the most invasive aquatic plant weed which is called as 'Terror of Bengal'.
3. How does Zygote usually differ from Zoospore in terms of ploidy?
4. Mention the main difference between the offspring produced by asexual reproduction and progeny produced by sexual reproduction.
5. Which characteristic property of Bryophyllum is exploited by gardeners and farmers?
6. Higher organism have resorted to sexual reproduction inspite of its complexity. Why?
7. Tapeworms posses both male and female reproductive organs. What is the name given to such organism? Give two more examples of such organisms.
8. Study the relationship between first two words and suggest a suitable word for fourth place.
   (a) Male flower : Stamens :: Female Flower : .....
   (b) Birds : oviparous :: Primates : .....
   (c) Chlamydomonas : Zoospores :: Penicilium : .....
   (d) Ginger : Rhizome :: Agave : .....

9. Bryophytes and Pteridophytes produce a large number of male gametes but relatively very few female gametes. Why?

10. Mention the site of zygote formation in the ovule of a flowering plant. What happens to sepals, petals and stamens after fertilisation? State the fate of zygote, ovule and ovary in these plants.

11. Distinguish between gametogenesis and embryogenesis.

12. Fill the blank spaces a, b, c, and d given in the following table.

Organism	Organ	Gamete
a	Testes	Spermatozoa
Human female	b	Ovum
Plant (Angiosperm)	c	Pollen grains
Plant (pteridophytes)	antheridium	d

LA (5 MARKS)

13. (a) Distinguish between asexual and sexual reproduction. Why is vegetative reproduction also considered as a type of asexual reproduction?

(b) Which is better mode of reproduction : Sexual or Asexual? Why?

1. Because offsprings produced by Asexual reproduction is morphologically and genetically identical to parent.

2. Water hyacinth *(Eicchornia)*

3. Zygote – diploid, zoospore – haploid.

4. Offspring produced by asexual reproduction are genetically similar while progeny produced by sexual reproduction exhibit genetic variation.

5. Adventitious bud arising from margin of the leaf.

LA (II 2 MARKS)

6. Because of variations, gene pool, Vigour and Vitality and Parental care.

7. Hermaphrodite; Examples : Earthworm, Leech.

8. (a) Carpel (b) Viviparous

(c) Conidia (d) Bulbil

9. Because male gemete need medium (water) to reach egg/female gamete. A large number of the male gametes fail to reach the female gamete.

LA – I (3 MARKS)

10. Embryo sac

Sepals, Petals and Stamens dry and fall off. Zygote develops into embryo. Ovule develops into seed and ovary into fruit.

11.

Gametogenesis	***Embryogenesis***
1. Formation of gametes	1. Formation of embryo
2. Produces haploid gametes	2. Embryo is diploid
3. Cell division is meiotic	3. Cell division is mitotic.

12. a = Human male b = ovary

c = Anther d = Antherozoid

13. (a)

Asexual Reproduction	**Sexual Reproduction**
(i) Uniparental	(i) Biparental
(ii) Gametes are not involved	(ii) Gametes are involved
(iii) Only mitotic division takes place	(iii) Meiosis at the time of gamete formation and mitosis after fertilisation
(iv) Offspring genetically similar to parent	(iv) Offspring different from parent.

Vegegative propagation takes plce when new individuals arise from vegetative part of parent and have characters similar to that of parent plant.

(b) Sexual reproduction introduces variations in offsprings and has evolutionary significance. It helps offsprings to adjust according to the changes in environment. It produces better offsprings due to character combination.

CHAPTER 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS

POINTS TO REMEMBER

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

Coleorhiza : A protective sheath of radicle in monocot seed.

Coleoptile : A protective sheath of plumule in monocot seed.

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

Geitonogany : Self pollination between flowers of the same plant.

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

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

Tapetum : Inner most layer of cells in pollen sac which provide nutrition to developing pollen grains

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

1. **Microsporangium (Pollen sac) :**

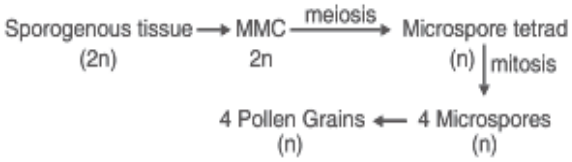
   Outermost layer = Epidermis

   Second layer = Endothecium

   Middle layer = 2 – 4 layers of cells

   Innermost layer = Tapetum [Nourishes the developing Pollen grains (Microspores)]

2. **Microsporogenesis :** Process of formation of microspores from a pollen mother cell



3. **Pollen grain** →
   - outerwall (Exine) – Thick, hard, made of sporopollenin
   - innerwall (Intine) – Thin, made of cellulose and Pectin
   - cell – a vegetative cell (large in size) and a generative cell (small in size)

4. Megasporogenesis – Process of formation of megaspore from the mega spore mother cell.

$$\underset{(2n)}{\text{Megaspore mother cell}} \xrightarrow{\text{meiosis}} \underset{(n)}{\text{four megaspores}}$$

5. Megasporangium (Ovule) :

- ❑ The ovule is a small structure attached to the placenta by means of a stalk called funicle.
- ❑ The point of attachment of the body of the ovule to the funicle is known as hilum. The main body of the ovule is composed of paranchymatous cells known as nucellus.
- ❑ Each ovule has one or two protective integument, which encircle the ovule except at the tip having small opening called micropyle.
- ❑ Opposite to micropylar end, is chalaza.
- ❑ Generally a single embryosac or female gametophyte located in nucellus.
- ❑ Cells of nucellus have abundant reserve food material and provide nourishment to the developing embryo.

6. Female gametophyte (Embryoa sac) : In a majority of flowering plant one of the megaspore is functional while other three degenerate.

- ❑ The functional megaspore develops in embryo sac.
- ❑ The nucleus of the functional megaspore (n) undergoes three successive mitotic cell division which results the formation of eight nucleate stage of embryo sac (free nuclera division)
- ❑ The cell wall formation starts at eight nuclear stages. Three cells are grouped together at micropylar end to form the egg apparatus (2

synergids + 1 egg cell).

- ❑ Three cells are grouped at chalazal end, called antipodal cells.
- ❑ The remaining 2 nuclei are called polar nuclei move to the centre of embryo sac, called central cell.

Thus typical angiospermic embryo sac at maturity is 8 nucleated and 7 celled.

7. Pollen – pistil interaction

- ❑ The pistil has the ability to recognize the pollen, whether it is or right type (Compatible) or of the wrong type (incompatible).
- ❑ If it is compatible, the pistil accepts the pollen.
- ❑ The pollen grains germinate on stigma to produce tubes. The contents of the generative cell (or the two male gametes in those species whose pollen is liberated in the three celled stage).
- ❑ Pollen tube grows through the tissue of stigma and style by secreting enzyme and enters the ovule.

8. **Double Fetilisation :** The pollen tube releases two male gamete into the cytoplasm of synergid

Syngamy : One male gamete + Egg cell „_ Zygote (2n)

Triple Fusion : Second male gamete + 2 polar nuclei „_ PEN (3n)

9. **Post Fertilisation events :** (i) Endosperm and embryo development (ii) Maturation of ovule and ovary

Ovary	Fruit	(2n)
Ovary wall	Pericarp	(2n)
Ovule	Seed	(2n)
Outer Integument	Testa	(2n)
Inner Integument	Tegmen	(2n)
Zygote	Embryo	(2n)
Primary Endosperm cell	Endosperm	(3n)

Embryo formation starts after certain amount of endosperm is formed

Zygote → Pro-embryo → Globular embryo → Heart shaped embryo → Mature embryo

10. **Dicot Embryo :** A typical dicot embryo consist of an embryonal axis and two cotyledons. The portion of embryonal axis above the level of cotyledons is the epicotyle which terminates with the plumule or stem tip.

    The portion below the level of cotyledons is hypocotyl that terminates at its lower end in the radicle or root tip.

    Monocot Embryo : Monocot (Rice, Maize etc.) has one cotyledon called Scutellum. The embryonal axis has the radicle and root cap enclosed by a sheath called Coleorrhiza.

    The upper end (epicotyle) has plumule which is covered by hollow folder sturcture, the coleoptile.

    Apomixis : Apomixis is a form of asexual reproduction that mimics sexual reproduction where seed are formed without fertilisation.

    Polyembryony : Occurance of more than one embryo in a seed. e.g. Orange, lemon, onion, mango, ground nut.

    Reasons : More than one egg may be formed in the embryo sac. More than one embryo sac may be formed in an ovule.

QUESTIONS

VSA (1 MARK)

1. In a young anther, a group of compactly arranged homogenous cells were observed in the centre of each microsporangium. What is the name given to these cells?
2. Give the scientific name of a plant which came to India as a contaminant with imported wheat and causes pollen allergy.
3. Pollen grains of water pollinated species have a special characteristics for protection from water. What is that?
4. Why are pollen grains produced in enormous quantity in Maize?
5. In same species of Asteraceae and grasses, seed are formed without fusion of gametes. Mention the scientific term for such form of reproduction.
6. Arrange the following in correct developmental sequence :

   Male gamete, Potential pollen mother cell, sporogenous tissue, Pollen grains, Microspore tetrad.
7. If the diploid number of chromosomes in an angiospermic plant is 16. Mention number of chromosomes in the endosperm and antipodal cell.

SA-II (2 MARKS)

8. In angiospermic plant before formation of microspore sporogenous tissue undergo cell division

   (a) Name the type of cell division.

   (b) What would be the ploidy of the cells of tetrad?

9. Outer envelop of pollen grain made of a highly resistant substance. What is that substance? At which particular point the substance is not present?

10. Fruits generally develops from ovary, but in few species thalamus contributes to fruit formation.

    (a) Name the two categories of fruits.

    (b) Give one example of each.

11. Among the animal, insects particularly bees are the dominant pollinating agents. List any four characteristic features of the insect pollinated flower.

12. Differentiate between geitonogamy and xenogamy.

13. In the given figure of a dicot embryo, label the parts (A) and (B) and give their function.

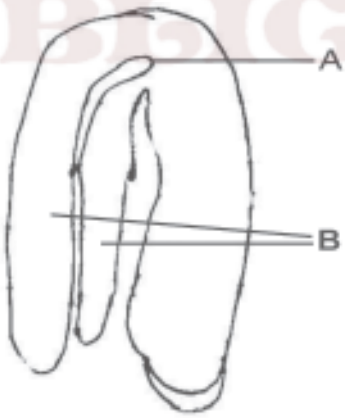


Figure 1

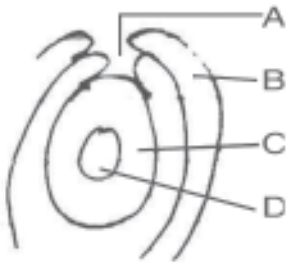
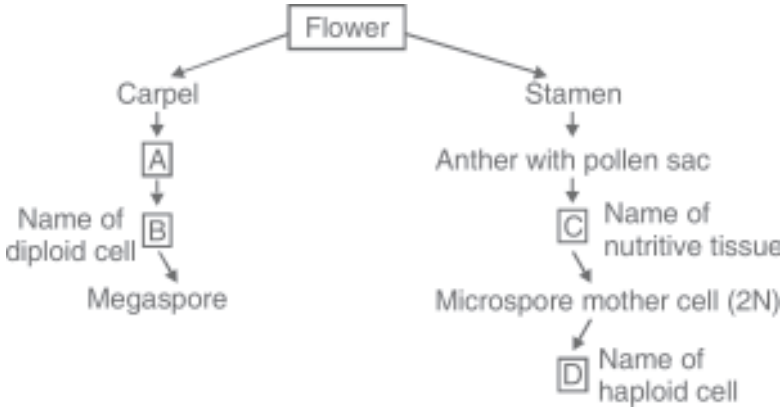


Figure 2

14. Name the parts A, B, C and D of the anatropous ovule (Figure 2) given above.

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



16. Name the blank spaces a, b, c and d is the table given below :

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

17. Even though each pollen grain has two male gametes. Why are at least 10 pollen grains and not 5 pollen grains required to fertilise 10 ovules present in a particular carpel?

SA-I (3 MARKS)

18. Continued self pollination lead to inbreeding depression. List three devices, which flowering plant have developed to discourage self pollination?
19. What will be the fate of following structures in the angiospermic plant? Ovary wall, Ovule, zygote, outer integument Inner integument and primary endosperm nucleus.
20. Differentiate between microsporogenesis and megasporogenesis. What type of cell division occurs during these events. Name the structure formed at the end of these two events.

LA (5 MARKS

21. Draw the embryo sac of a flowering plants and label :

    (a) (i) Central Cell (ii) Chalazal end (iii) Synergids

    (b) Name the cell that develops into embryo sac and explain how this cell leads to formation of embryo sac.

    (c) Mention the role played by various cells of embryo sac.

    (d) Give the role of filiform apparatus.

ANSWERS

1. Sporogenous tissue
2. *Parthenium*
3. Presence of mucilagenous covering
4. To ensure pollination because Maize is pollinated by wind.
5. Apomixis
6. Sporogenous tissue – Potential pollen mother cell – microspore tetrad – Pollen grain – male gamete.
7. 24 Chromosomes in endosperm and 16 chromosomes in antipodal cell.

SA - II (2 MARKS)

8. (a) meiosis division (b) haploid
9. Sporopollenin; at germpore sporopollenin is absent.
10. Two categories of fruits are :

    (i) True fruits e.g., Mango

    (ii) False fruit e.g., Apple

11. 1. Flowers are large.

    2. Colorful petals of flower.

    3. Presence of fragrance.

    4. Rich in nectar.

12.

Geitonogamy	*Xenogamy*
1. Transfer of pollen grains from the another to stigma of another flower of the same plant	Transfer of Pollen grains from another to stigma of defferent plant.
2. Does not provide opportunity for gametic recombination.	Provide opportunity for gametic recombination.

13. A = Plumule – To form shoot system

    B = Cotyledons – Storage of food

14. A = Micropyle, B = Outer integument, C = Nucellus, D = Emnbryo sac

15. A = Ovule/megasporangium, C = Tapetum

    B = Megaspore mother cell, D = Pollen grains

16. a = wall of fruit, b = scutellum, c = shoot and root tip, d = perisperm

17. Because only one male gamete is involved in syngamy. ie fursionof male gamete with egg cell.

SA - I (3 MARKS)

18. (a) Release of pollen and stigma receptivity is not synchronised in some species

    (b) Anther and stigma are at different position/heights in some plants

    (c) Self-incompatibility a genetic mechenism.

19. Ovary wall = Pericarp ; Ovule = Seed,

    Zygote - Embryo; Outer integument = Testa;

    Inner integument = Tegmen; Primary endosperm nucleus = Endosperm.

20. Microsporogenesis – Process of formation of microspore from a Pollen mother cell.

    Megsporogenesis – Process of formation of megaspore from megaspore mother cell.

    Meiotic division in both

Microsporogenesis results in the formation of pollen grain while megasporogenesis results in the formation of megaspore.

LA (5 MARKS)

21. A. Refer to figure 2.8(c) page 26 NCERT book.

B. Functional Megaspore, Refer text on page 27 NCERT book.

C. Egg : Fuses with male gamete to form zygote or future embryo

Synergid : Absorption of nutrient, attract and guides pollen tube.

Central Cell : After fusion with second male gamete forms Primary endosperm cell which gives rise to Endosperm

D. Guides the entry of pollen tube.

CHAPTER 3

HUMAN REPRODUCTION

POINTS TO REMEMBER

Acrosome : A small, sheathy structure at the end of a sperm.

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

Endometrium : Innermost glandular layer lining the uterine cavity.

Foetus : An advanced stage of embryo within the uterus.

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

Hymen : A thin membrane partially covering the vaginal aperture.

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

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

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

Oogenesis : Formation and development of ova in ovary.

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

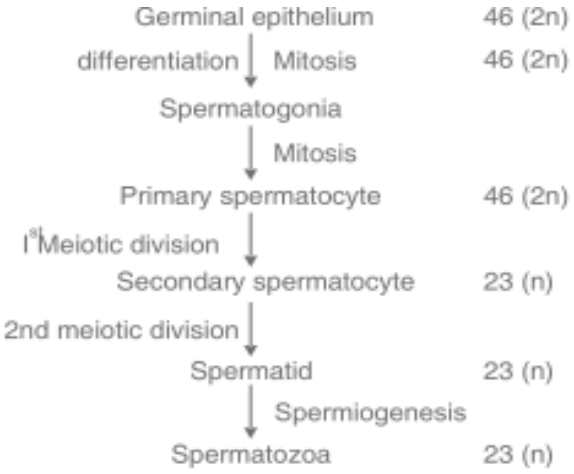
Parturition : Process of delivery of the foetus (Child birth).

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

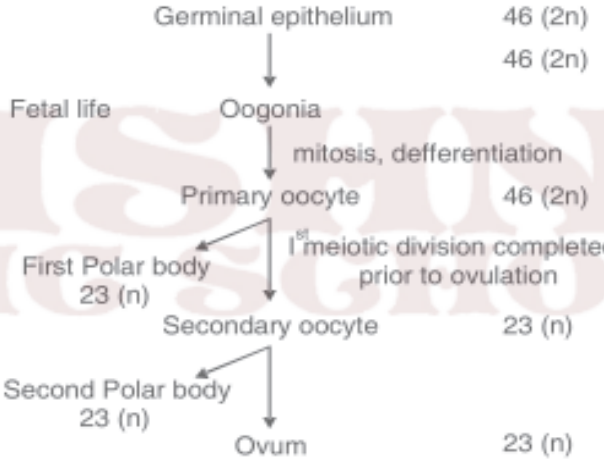
Scrotum : A muscular pouch which houses two testes.

Spermiation : A process by which spher matozora are released from the sominiferous tubules.

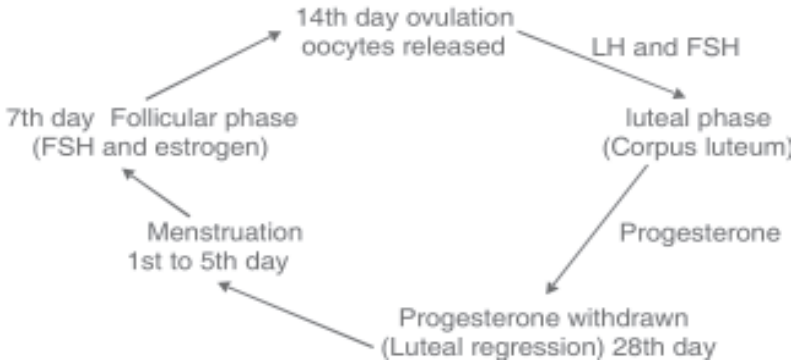
Spermatogenesis : Process of formation of sperm from malegerm. cell in the testes.



Oogenesis : Process of formation of ova in ovary



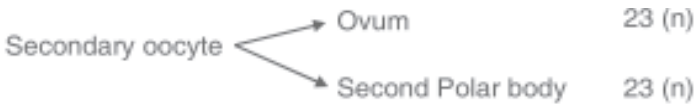
Phases of Menstrual Cycle : Menstrual phase, Follicular (Proliferative) Phase, ovulatory phase and Luteal (secretory) phase

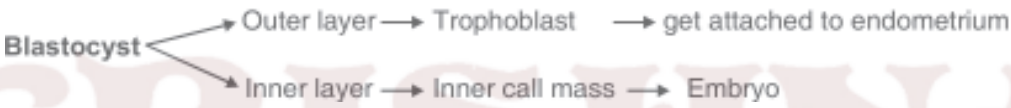


Fertilisation : Process of fusion of sperm with ovum

Site of fertilisation in human female : Ampullary – isthmic junction

Secretion of acrosome helps the sperm entry into cytoplasm of ovum through zona pellucida and plasma membrane. Sperm entry induce the completion of the 2nd meiotic division of secondary oocyte.





Placenta : An intimate connection between foetus and uterine wall of the mother to exchange materials.

Function of Placenta : Nutrition, Respiration, Excretion, as barrier, Endocrine function.

Placenta as Endocrine tissue : Placenta Produces several hormones such as – Estrogen, hCG, hPL, Progesterone and relaxin (in late phase of pregnancy).

Embryonic Development : at various month of Pregnancy After–1 month = Heart, 2 months = Limbs and digits, 3 months = External genital organ, 5 months = First movement, 6 months = body covered with fine hairs, eye lid, eye lashes, 9 months = Fully developed and ready for delivery.

VSA (1 MARK)

1. Failure of testes to descend into scrotal sacs leads to sterility. Why?
2. Both vaccine and colostrum produce immunity. Name type of immunity produced by these.
3. How many sperms will be produced from 10 primary spermatocytes and how many eggs will be produced from 10 primary oocytes?

4. The spermatogonial cell has 46 chromosomes in human male. Give the number of chromosomes in –

   (a) Primary spermatocyte (b) Spermatid

5. In ovary which structure transforms as corpus luteum and name the hormone secreted by corpus luteum?

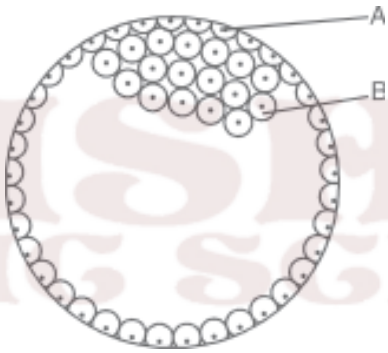
6. "Each and every coitus does not results in fertilisation and pregnancy". Justify the statement.

VSA-II (2 MARKS)

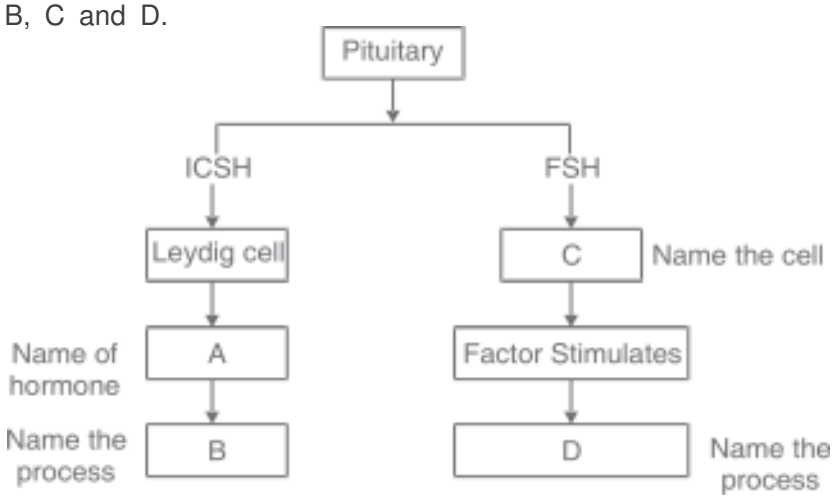
7. Give the function of

   (a) Corpus luteum (b) Endometrium

8. In the given figure, give the name and functions of parts labelled A and B.



9. Given below is an incomplete flow chart showing influence of hormone on gametogenesis in male, observe the flow chart carefully and fill in the blank A, B, C and D.



10. Give reason for the following :

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

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

11. What is meant by L.H. Surge? Write the role of L.H.

12. Explain significance of the condition in which the testes remain suspended in scrotum outside the abdomen.

SA-I (3 MARKS)

13. Mention the name and role of hormones which are involved in regulation of gamete formation in human male.

14. Three of the steps of neuro endocrine mechanism in respect of parturition are mentioned below.

    Write the missing steps in proper sequence.

    (a) Signals originate from fully developed foetus and placenta.

    (b) _____.

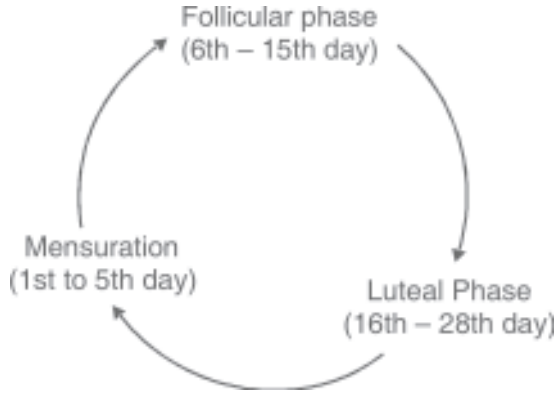
    (c) _____.

    (d) Oxytocin causes strong uterine contraction

    (e) Uterine contraction stimulates further secretion of oxytocin.

    (f) _____.

15. The events of the menstrual cycle are represented below. Answer the following questions.

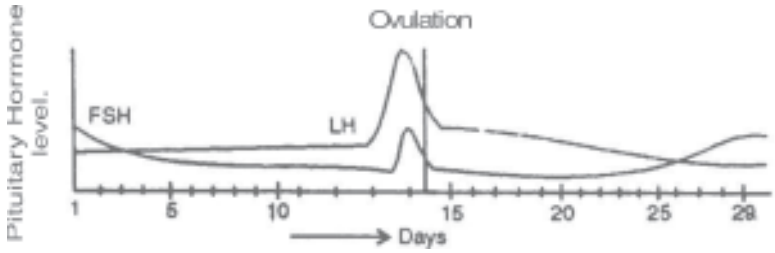


    (i) State the levels of FSH, LH and Progesterone simply by mentioning high or low around 13th and 14th day and 21st to 23rd day.

(ii) In which of the above mentioned phases does egg travel to fallopian tube?

(iii) Why there is no mensuration after fertilisation?

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



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

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

17. T.S. of mammalian testis revealing seminiferous tubules show different types of cell.

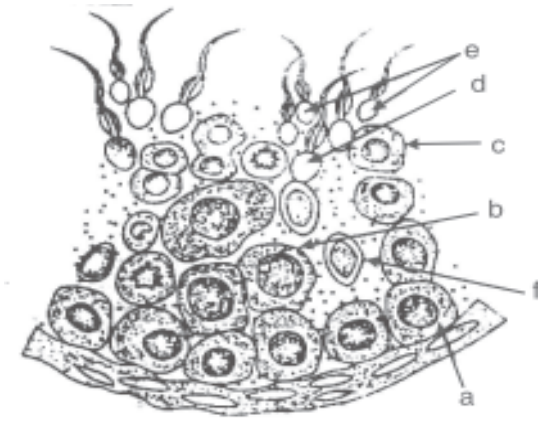
(i) Name the two types of cells of germinal epithelium.

(ii) Name of cells scattered in connective tissue and lying between seminiferous tubules.

Differentiate between them on the basis of their functions.

LA (5 MARKS)

18.



Study the figure given :

(i) Pick out and name the cells that undergo spermiogenesis.

(ii) Name 'A' and 'C' cells.

(iii) Give ploidy of 'B' and 'E'

(iv) What are the cells marked as 'F'? Mention their function.

(v) Mention the type of cell division in A and B.

ANSWERS

VSA (1 MARKS)

1. High temperature of abdomen kills the spermatogenic tissue of the testes, so no sperm are formed.
2. Vaccine – Active immunity Colostrum – Passive immunity.
3. 40 sperms, 10 eggs.
4. (i) 46 in Primary spermatocyte

   (ii) 23 in spermatid.
5. ❑ Follicular cells of empty Graafian follicle.

   ❑ Progesterone.
6. Ovum and sperm should reach simultaneously to the ampullary - isthmic junction.

SA-II (2 MARKS)

7. **Corpus luteum :** It secretes progesterone which prepares endometrium of uterus for implantation and normal development of foetus.

   Endometrium : It undergoes cyclic changes during menstrual cycle and prepares itself for implantation of blastocyst.
8. A = Trophoblast – Gets attached to endometrium and draws nutritive material secreted by uterine endometrium gland.

   B = Inner cell mass – Differentiates as Embryo.
9. A = Testosterone; B = Spermatogenesis

   C = Sertoli cells; D Spermiogenesis

10. (a) During this phase, primary follicles transform into Graafian follicle under FSH stimulation. Graafian follicles secrete estrogens with stimulate enlargement of Endometrium of uterus.

    (b) During this phase, Corpus luteum is fully formed and secretes large quantity of Progestrone.

11. Refer page 51 NCERT book

12. Refer page 43 NCERT book.

SA-1 (3 MARKS)

13. **GnRH :** Stimulates adenophysis to secrete gonadotrophins.

    GSH : Stimulates Sertoli cells to secrete factors while help in spermatogenesis.

    ICSH : Stimulates interstitial cells to secrete testosterone.

14. (b) Foetal ejection reflex

    (c) The reflex triggers release of oxytocin

    (f) Expulsion of the baby out through birth canal.

15. (i)

		13 – 14th day	*21st – 23rd day*
FSH	→	High	Low
LH	→	High	Low
Progesterone	→	Low	High

    (ii) End of follicular or proliferative phase.

    (iii) Menstruation does not occur during pregnancy upon fertilisation due to high level of progestenone secreted by persisting corpus luteum and Placenta.

16. (a) (i) Gonadotropins and FSH increases

    (ii) LH attains peak level but FSH decreases

    (iii) LH and FSH level decreases

    (iv) LH remains low and FSH increases.

    (b) After 29th day there is a mentrual flow involving discharge of blood and cast off endometrium lining.

17. (i) Germinal epithelium have two types of cell. 1. Spermatogonium. 2. Sertoli cells

(ii) Leydig cells or Interstitial cells.

Functions

Spermatogonium undergoes meiotic division leading to sperm formation.

Sertoli cell : Nourishes germ cells

Leydig cell : Synthesise and Secrete hormone androgen.

18. (i) 'D' Spermatids = undergo spermiogenesis

(ii) 'A' = Spermatogonium; B = Primary spermatocyte

(iii) 'B' = Diploid E = Haploid

(iv) 'F' = Sertoli cells – Nutrition to germ cells

(v) Mitosis in Cell 'A', Meiosis in cell 'B'

CHAPTER 4

REPRODUCTIVE HEALTH

POINTS TO REMEMBER

Amniocentesis : Diagnostic technique to detect genetic disorder in the foetus.

Infertility : Inability to produce children in spite of unprotected sexual cohabitation of a couple.

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

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

IUCD : Intra Uterine Contraceptive Device

RCH : Reproductive and Child Health care

STD : Sexually Transmitted Disease

CDRI : Central Drug Research Institute

MMR : Maternal Mortality Rate

MTP : Medical Termination of Pregnancy

VD : Veneral Disease

RTI : Reproductive Tract Infection

PID : Pelvic Inflammatory Disease

ART : Assisted Reproductive Technologies

IVF : In Vitro Fertilisation

ZIFT : Zygote Intra Fallopian Transfer

Reasons for Infertility

(i) Physical
(ii) Congenital diseases
(iii) Drugs
(iv) Immunological reaction

The couple can be assisted to have children through certain special techniques commonly known as assisted reproductive technologies (ART).

(i) **In Vitro Fertilisation (IVF) :** Fertilization outside the body in almost similar conditions as that in the body, followed by embryo transfer (E.T.).

Test Tube baby Programme : Ova from the wife/donor female and sperm from husband/donor male are allowed to fuse under simulated condition in the laboratory.

ZIFT : Zygote intra fallopian transfer – Zygote or early embryo upto Eight blastomeres is transferred into the fallopian tube.

IUT : Intra Uterine Transfer – Embryo with more than eight blasomeres are transferred.

(ii) **Gamete intra fallopian transfer (GIFT) :** Transfer of an ovum collected from a donor to fallopian tube of another female who can not produce ova, but can provide suitable conditions for fertilization and further development of the foetus upto parturition,

(iii) **Intra Cytoplasmic sperm injection (ICSI) :** The sperm is directly injected into the ovum to form an embryo in the laboratory and then embryo transfer is carried out.

(iv) **Artificial Insemination :** This method is used in cases where infertility is due to the inability of the male partner to inseminate the female or due to very low sperm counts in the ejaculates. In this method, the semen collected from the husband or a healthy donor is artifictally introduced into the vagina or into the uterus (IUI-Intra uterine insemination).

Method of Birth Control

(i)	Natural Methods :	Periodic abstinence Coitus interruptus Lactational amenorrhea.
(ii)	Barrier methods :	Condom, Diaphragms, Cervical cap.
(iii)	Intra uterine devices :	Non – medicated e.g. Lippes loop Copper releasing e.g., Cu-T, multiload 375 Hormone releasing e.g. LNG–20, progestasert
(iv)	Oral contraceptives :	Pills / Saheli Small doses of either progestogens or Progestogen – estrogen combination
(v)	Surgical (Sterilisation) :	(1) Tubectomy; (2) Vasectomy

QUESTIONS

VSA (1 MARK)

1. Give the term for prenatal diagnostic technique aimed to know the sex of developing foetus and to detect congenital disorders.
2. After a successful in vitro fertilisation, the fertilised egg begins to divide. Where is this egg transferred before it reaches the 8-celled stage and what is this technique called?
3. Give the term for rapid population growth.
4. Name the fluid from which foetal cells are extracted for chromosomal analysis.
5. Give technical name of female used to bring up in vitro fertilized egg to maturity.
6. Name the oral contraceptive developed by CDRI, Lucknow.

SA-II (2 MARKS)

7. Lactational Amenorrhea is a method of contraception Justify. What is the maximum effectiveness of this method in terms of period/duration?
8. How are non medicated IUD'S different from hormone releasing IUD'S? Give examples.
9. What are implants? How do they help in preventing fertilisation?
10. Briefly explain two natural barriers for birth control.
11. Enlist any four possible reasons for infertility in human beings.

SA-1 (3 MARKS)

12. Give another name for sexually transmitted diseases. Name two sexually transmitted diseases which are curable and two diseases which are not curable.
13. Differentiate between Vasectomy and Tubectomy.
14. Name the techniques which are employed in following cases :
    (a) Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce ova but can provide suitable environment for fertilisation and development.

(b) Embryo is formed in laboratory in which sperm is directly injected into ovum.

(c) Semen collected either from husband or a healthy donor is artificially introduced either into vagina or uterus.

15. Mention the various precautions one has to take in order to protect himself/ herself form STDs.

16. What are the disturbing trends observed regarding MTP?

LA (5 MARKS)

17. Briefly explain the various reproductive technologies to assist an infertile couple to have children.

ANSWERS

VSA (1 MARKS)

1. Amniocentesis.
2. Fallopian tube; Zygote intra fallopian transfer (ZIFT)
3. Population explosion.
4. Amniotic fluid.
5. Surrogate mother.
6. Saheli

SA-II (2 MARKS)

7. (a) Ovulation and menstrual cycle do not occur during the period of intense lactation following parturition. Therefore, as the mother breast feeds, chances of conception are nil.

   (b) It is effective only upto a maximum period of six months following parturition.

8. (a) Non medicated IUDs = Lippes loop, Copper releasing IUD'S (CuT, Multiload 375) $\rightarrow$ These increase phagocytosis of sperms within uterus and release copper ions which suppress sperm motility and fertilising capacity of sperm.

   (b) Hormone releasing IUDs – Progestasert, LNG–20 – These makes uterus unsuitable for implantation and the cervix hostile to sperms.

9. The structures which contain hormones like progesterone and estrogen and are placed under the skin.

10. Periodic abstinence – couple should avoid coitus from 10th to 17th day of menstrual cycle.

    Coitus interruptus – Male partner withdraws his penis from the vagina just before ejaculation of semen.

11. Physical, congenital disease, Drugs, Immunological and even psychological (any four).

SA-I (3 MARKS)

12. Veneral disease (VD)/Reproductive tract infection (RTI)

    Curable : Syphilis, Gonorrhoea

    Non Curable : Hepatitis B, AIDS, Genital herpes

13.

	Vasectomy	***Tubectomy***
1.	Method of sterilisation in males	1. Method of sterilisation in females.
2.	Vasa defferentia of both sides are cut and tied	2. Fallopian tube of both sides are cut and tied.
3.	Prevents movement of sperms at cut end.	3. Prevent movement of egg at cut end.

14. (a) Gamete intra fallopian transfer.
    (b) Intra cytoplasmic sperm injection
    (c) Intra uterine insemination.

15. (i) Avoid blood transfusion from an infected person.
    (ii) Avoid sex with an unknown partner or multiple partners.
    (iii) Always use condom.
    (iv) Avoid sharing of injections needles and syringes and surgical instruments.

16. Majority MTP's performed illegally by unqualified quacks, missuse for female foeticide.

LA (5 MARKS)

17. Refer page no. 64, NCERT textbook for class XII/Points to remember in this chapter.

CHAPTER 5

PRINCIPLES OF INHERITANCE AND VARIATION

POINTS TO REMEMBER

Allele : Various or slightly different forms of a gene, having same position on chromosomes.

Phenotype : The observable or external characteristics of an organism

Genotype : The genetic constitution of an organism.

Monohybrid cross : A cross between two individuals of species, considering the inheritance of single pair of contrasting character e.g., a cross between pure tall (TT) and Dwarf (tt).

Dihybrid cross : A cross between two individuals of a species, considering the inheritance of two pairs of contrasting traits/characters e.g., a cross between Round and Yellow (RRYY) and wrinkled and green (rryy) pea seeds

Incomplete dominance : When one of the two alleles of a gene is incompletely dominant over the other allele.

Co-dominance : When two alleles of a gene are equally dominant and express themselves even when they are together.

Multiple allelism : When a gene exists in more than two allelic forms e.g., gene for blood group exist in three allelic forms, I^A, I^B and i.

Aneuploidy : The phenomenon of gain or loss of one or more chromosome(s), that results due to failure of separation of homologous pair of chromosomes during meiosis.

Trisomy : The condition in which a particular chromosome is present in three copies in a diploid cell/ nucleus.

Male heterogamety : When male produces two different types of gametes/ sperms e.g., In human beings X and Y.

Mutation : The sudden heritable change in the base sequence of DNA, or structure of chromosome or a change in the number of chromosomes.

Pedigree Analysis : The analysis of the distribution and movement of trait in a series of generations of a family.

Female Heterogamety : When female produces two different types of gametes/ova e.g., female bird produces Z and W gametes.

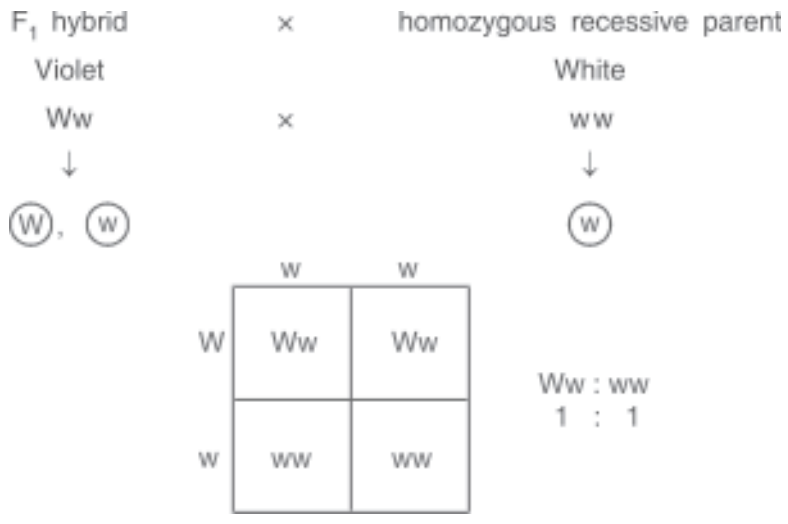
Law of Dominance : When two individuals of a species differing in a pair of contrasting characters/traits are crossed, the trait that appears in the F_1 hybrid is dominant and the alternate from that remain hidden, is called recessive.

Law of Segregation : The members of allelic pair that remained together in the parent, segregate/separate during gamete formation and only one of the factors enters a gamete.

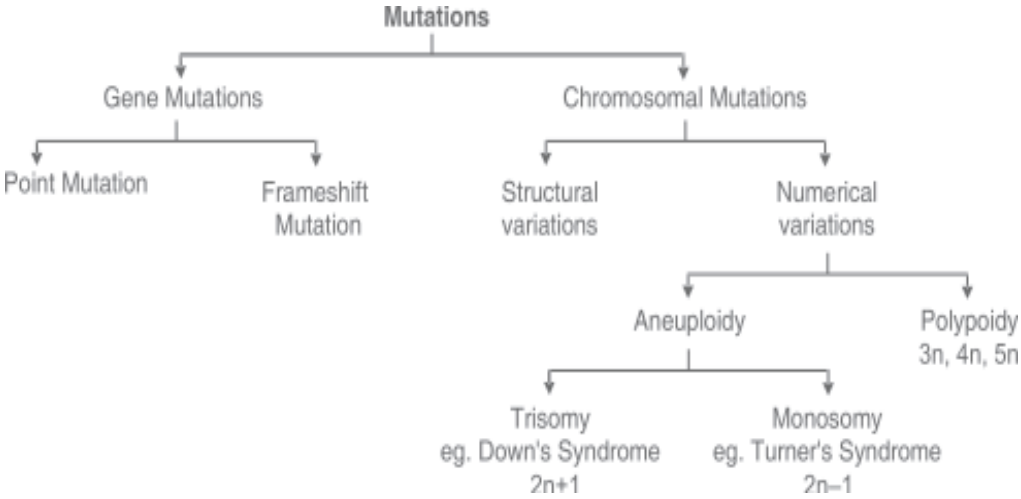
Law of Independent Assortment : In the inheritance of two pairs of contrasting characters, the factors of each pair of characters segregate independently of the factors of the other pair of characters.

Test Cross : When offspring or individual with dominant phenotype, whose genotype is not known, is crossed with an individual who is homozygous recessive for the trait.

The progeny of monohybrid test cross ratio is 1 : 1 while the dihybrid test cross ratio is 1 : 1 : 1 : 1.



Use of Test Cross : The test cross is used to find the genotype of an organism.



Incomplete dominance : It is the phenomenon where none of the two contrasting alleles is dominant but express themselves partially when present togoether in a hybrid and somewhat intermediate.

Co-dominance : The alleles which do not show dominance recessive relationship and are able to express themselves independently when present together are called co-dominant alleles and this phenomenon is known as co-dominance. Example : Human blood groups.

Blood Group	Genotype
A	I^AI^A, I^Ai
B	I^BI^B, I^Bi
AB	I^AI^B
O	ii

In human blood, there are six genotype and four phenotypes.

Chromosonal Theory of Inhertance : proposed by Suttan and Boveri. The pairing and separation of a pair of chromosomes would lead to the segregation of a pair of factors they carried. They united the knowledge of segregation with mendelian principles.

Linkage – is the tendency of genes on a chromosome to remain together.

– Linked genes occur in the same chromosome

– They lie in linear sequence in the chromosome

– There is a tendency to maintain the parental combination of genes except for accessional choosers.

– Strength of linkage between genes is inversely proportional to the distance between the two.

Recombination – is the generation of non-parental gene combinations to the offsprings.

Tightly linked genes show very low recombination frequency. Loosely linked genes show higher recombination frequency.

The frequency of recombination between gene pairs on the same chromosome is a measure of distance between genes and is used to map the position of genes on the chromosome.

Chromosomal basis of sex determination

(i) XX - XY type - female homogametic ie XX and male heterogametic ie. XY is *Drosophila*, humans.

(ii) XX - XO type All eggs bear additional X chromosome, Makes have only one X chromosome besides autosomes whereas females have a pair of X chromosomes eg grasshoppers.

(iii) ZW - ZZ type - The females are hetegametic and have one Z and one W chromosome. The males are homogametic with a pair of Z chromosomes besides autosomes eg - birds.

Pedigree Analysis

A record of inheritance of certain genetic traits for two or more generation presented in the form of diagram or family tree is called pedigree.

Usefulness of Pedigree Analysis

1. It is useful for genetic counsellors to advice intending couples about the possibility of having children with genetic defects like haemophilia, thalassemia etc.

2. It is helpful to study certain genetic trait and find out the possibility or absence or presence of that trait in homozygous or heterozygous condition in a particular individual.

Mendelian disorders

These are mainly determined by alternation or mutation in single genes. or mutation in single genes.

1. **Haemophilia –** sex linked recessive disease which is transmitted from unaffected carriers female to male pregnancy. A single protein is affected that is a part of the cascade of proteins involved in the clothing of blood.

   X^h Y – Sufferer male

   X^h X – carrier female

The heterozygous female for haemophilia may transmit the disease to her sons. The possibility of a female suffering from the disease is extremely rare (only when the mother of the female is a carrier ie X^hX and father is haemophilic ie. X^hY.

2. **Sickle - cell anaemia :** This is an autosome linked recessive trait. The defect is caused by substitution of glutamic acid by valine at the 6^{th} position of the beta globin chain of the haemoglobin molecule. The mutant Hb molecule undergoes polymerisation under low oxygen tension causing change in shape of RBC from biconcave disc to elongated sickle like structure. The disease is controlled by a pair of allele, Hb^A and Hb^S

   Hb^A Hb^A – Normal

   Hb^A Hb^s – Apparently unaffected, carriers Hb^s Hb^s – sufferer

   Phenylketonuria – Inborn error of metabolism autosomal recessive trait.

Affected individual lacks an enzyme that converts amino acid Phenylalanine into tyrosine. Phenylalanine is accumulated and converted into phenylpyruvic acid which accumulates in brain resulting in mental retardation.

Chromosomal disorders

These are caused due to absence or excess of one or more chromosomes.

Down's syndrome – Trisomy of chromosome number 21.

Affected individual is short statured with small round head, furrowed tongue, partially open month, broad palm. Physical, psychomotor and mental development is retarded.

Klinefelter's syndrome – extra copy of X chromosome; karyotype XXY. Affected individual has overall masculine development with feminine characters like gynaecomastia (development of breast) and is sterile.

Turner's syndrome – has absence of one X chromosome ie. 45 with XO. Affected females are sterile with rudimentary ovaries and lack secondary sexual characters.

PLEIOTROPY

The ability of a gene to have multiple phenotypic effects because it influences a number of characters simultaneously is known as **pleiotropy.** The gene having a multiple phenotypic effect because of its ability to control expression of a number of characters is called pleiotropic gene.

Eg. in Garden Pea, the gene which controls the flower colour also controls the colour of seed coat and presence of red spot in the leaf axil.

POLYGENIC INHERITANCE

It is a type of inheritance controlled by two or more genes in which the dominant alleles have cumulative effect with each dominant allele expressing a part of the trait, the full trait being shown only when all the dominant alleles are present.

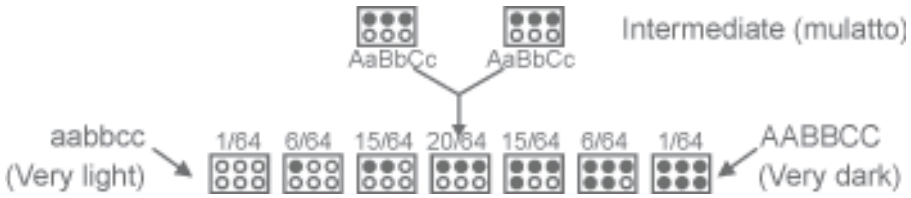
Eg. Kernel colour in wheat, skin colour in human beings, height in humans, cob length in maize etc.

In polygenic inheritance, a cross between two pure breeding parents produces an intermediate trait in F1. In F2 generation, apart from the two parental types, there are several intermediates (gradiations, show a bell shaped curve). F1 hybrid form 8 kinds of gamete in each sex giving 64 combination in F2 having 7 genotype and phenotype.

Polygenic inheritance of skin tone

3 loci : each has two possible alleles : Aa, Bb, Cc, each capital allele adds one unit of darkness, each lower case allele adds nothing

Parents with intermediate tone



Offspring can have tone darker or lighter than either parent

QUESTIONS

VSA (1 MARK)

1. Give any two reasons for the selection of pea plants by Mendel for his experiments.
2. Name any one plant that shows the phenomenon of incomplete dominance during the inheritance of its flower colour.
3. Name the base change and the amino acid change, responsible for sickle cell anaemia.
4. Name the disorder with the following chromosome complement.
   (i) 22 pairs of autosomes + X X Y
   (ii) 22 pairs of autosomes + 21st chromosome + XY.
5. A haemophilic man marries a normal homozygous woman. What is the probability that their daughter will be haemophilic?
6. A test is performed to know whether the given plant is homozygous dominant or heterozygous. Name the test and phenotypic ratio of this test for a monohybrid cross.

SA-II (2 MARKS)

7. Identify the sex of organism as male or female in which the sex chromosome are found as
   (i) ZW in bird (ii) XY in *Drosophila* (iii) ZZ in birds. (iv) XO in grasshopper.
8. Mention two differences between Turner's syndrome and Klinefelter's syndome.
9. The human male never passes on the gene for haemophilia to his son. Why is it so?
10. Mention four reasons why *Drosophila* was chosen by Morgan for his experiments in genetics.
11. Differentiate between point mutation and frameshift mutations.

SA-I (3 MARKS)

12. A woman with O blood group marries a man with AB blood group
    (i) work out all the possible phenotypes and genotypes of the progeny.
    (ii) Discuss the kind of dominance in the parents and the progeny in this case.

13. Explain the cause of Klinefelter's syndrome. Give any four symptoms shown by sufferer of this syndrome.

14. In Mendel's breeding experiment on garden pea, the offspring of F2 generation are obtained in the ratio of 25% pure yellow pod, 50% hybrid green pods and 25% green pods State (i) which pod colour is dominant (ii) The Phenotypes of the individuals of F1 generation. (iii) Workout the cross.

LA (5 MARKS)

15. A dihybrid heterozygous round, yellow seeded garden pea *(Pisum sativum)* was crossed with a double recessive plant.

    (i) What type of cross is this?

    (ii) Work out the genotype and phenotype of the progeny.

    (iii) What principle of Mendel is illustrated through the result of this cross?

ANSWERS

VSA (1 MARK)

1. (i) Many varieties with contrasting forms of characters

   (ii) Can easily be cross pollinated as well as self pollinated.

2. Dog flower (Snapdragon or Antirrhinum sp.)

3. GAG changes as GUG, Glutamic acid is substituted by valine.

4. (i) Klinefelter's Syndrome (ii) Down's syndrome

5. Their daughter can never be haemophilic. (0%).

6. Test cross 1 : 1.

SA-II (2 MARKS)

7. (i) Female; (ii) Male; (iii) Female (iv) Male

8. **Turner's Syndrome :** The individual is female and it has 45 chromosomes i.e., one X chromosome is less.

   Klinefelter's Syndome : The individual is male and has 47 chromosomes i.e., one extra X chromosome.

9. The gene for haemophilia is present on X chromosome. A male has only one X chromosome which he receives from his mother and Y chromosome from father. The human male passes the X chromosome to his daughters but not to the male progeny (sons).

10. (i) Very short life cycle (2-weeks)
    (ii) Can be grown easily in laboratory
    (iii) In single mating produce a large no. of flies.
    (iv) Male and female show many hereditary variations
    (v) It has only 4 pairs of chromosomes which are distinct in size and Shape.

11. **Point Mutations :** Arises due to change in a single base pair of DNA e.g., sickle cell anaemia.

    Frame shift mutations : Deletion or insertion/duplication/addition of one or two bases in DNA.

SA-I (3 MARKS)

12. (i) Blood group AB has alleles as I^A, I^B and O group has ii which on cross gives the both blood groups A and B while the genotype of progeny will be I^Ai and I^Bi.
    (ii) I^A and I^B are equally dominant (co-dominant). In multiple allelism, the gene I exists in 3 allelic forms, I^A, I^B and i.

13. **Cause :** Presence of an extra chromosome in male i.e., XXY.

    Symptoms : Development of breast, Female type pubic hair pattern, poor beard growth, under developed testes and tall stature with feminised physique.

14. (i) Green pod colour is dominant
    (ii) Green pod colour
    (iii) Parents GG(green) X gg (yellow)
    Gametes (G) (g)
    F1 generation Gg (Hybrid green)
    Gametes (G) (g) X (G) (g)
    F2 generation GG Gg Gg gg
    Phenotypic ratio 3 : 1
    Genotypic ratio 1 : 2 : 1

LA (5 MARKS)

15. (i) It is a dihybrid test cross

(ii) Parent RrYy (Round Yellow) rryy (Wrinkled green)

Gametes (RY), (Ry), (rY), (ry) X (ry)

	Gametes	RY	Ry	rY	ry
F_1 progeny	ry	RrYy Round, Yellow	Rryy Round and Green	rrYy Wrinkled Yellow	rryy Wrinkled, Green
Phenotypic ratio	:	1	: 1	: 1	: 1
Genytopic ratio	:	1	: 1	: 1	: 1

(iii) It illustrates the Principle of independent assortment.

CHAPTER 6

MOLECULAR BASIS OF INHERITANCE

POINTS TO REMEMBER

Anticodon : A sequence of three nitrogenous bases on tRNA which is complementary to the codon on mRNA.

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

Transcription : The process of copying genetic information from one strand of DNA into RNA.

Translation : The process of polymerisation of amino-acids to form a polypeptide as dictated by mRNA.

Nucleosome : The structure formed when negatively charged DNA is wrapped around positively charged histone octamer.

DNA Polymorphism : The variations at genetic level, where an inheritable mutation is observed.

Satellite DNA : The repetitive DNA sequences which form a large portion of genome and have high degree of polymorphism but do not code for any proteins.

Operon : A group of genes which control a metabolic pathway.

Exons : The regions of a gene which become part of mRNA and code for different regions of proteins.

Introns : The regions of a gene which are removed during the processing of mRNA.

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

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

Capping : Adding of methyl guanosine triphosphate to the 5´ end of hnRNA.

Splicing : The process in eukaryotic genes in which introns are removed and the exons are joined together to form mRNA.

Central Dogma :

Replication fork : The Y shaped structure formed when double stranded DNA is unwound upto a point during its replication.

VNTR : Variable Number Tandem Repeats

YAC : Yeast Artificial Chromosome

BAC : Bacterial Artificial Chromosome

SNPs : Single Nucleotide polymorphism

HGP : Human Genome Project

hnRNA : Heterogenous nuclear RNA. It is precursor of mRNA.

Chemical Structure of Polynucleotide Chain (DNA/RNA) : A nucleotide has three components—

1. ***Nitrogen base***

   (i) *Purines :* Adenine and Guanine

   (ii) *Pyrimidines :* Cytosine, Thymine and Uracil

   Thymine in DNA and Uracil in RNA.

2. **Pentose Sugar :** Ribose (in RNA) or Deoxyribose (in DNA).

3. **Phosphate Group**

   - ❑ Nitrogen base is linked to pentose sugar through N-glycosidic linkage.
   - ❑ Nitrogen base + Sugar = Nucleoside
   - ❑ Phosphate group is linked to 5′–OH of a nucleoside through phosphoester linkage.
   - ❑ Nucleoside + Phosphate group = Nucleotide.
   - ❑ Two nucleotides are linked through 3′–5′ phosphodiester linkage to form a dinucleotide
   - ❑ A polynucleotide chain has free phosphate group at 5′–end of ribose sugar and 3′–OH group at other end.

RNA is highly reactive than DNA : In RNA nucleotide has an addition –OH group at 2′–position in the ribose; RNA is also catalytic.

Double-helix Structure of DNA : Proposed by Watson and Crick in 1953.

(i) DNA is made up of two polynucleotide chains.

(ii) The backbone is made up of sugar and phosphate and the bases project inside.

(iii) Both polynucleotide chains are antiparallel i.e. one chain has polarity 5′-3′ and other chain has 3′–5′.

(iv) These two strands of chains are held together by hydrogen bonds i.e. A=T, G≡C.

(v) Both chains are coiled in right handed fashion. The pitch of helix is 3.4 nm with 10 bp in each turn.

Hershey and Chase Experiement : In 1952, Hershey and Chase performed an experiment on bacteriophages (Viruses that infect bacteria) and proved that DNA is the genetic material.

Bacteriophage Radioactive (35_S) labelled protein coat	Bacteriophage Radioactive (32_P) labelled DNA
↓	↓
Infection : *E.coli*	*E.coli*

↓

Blending : Viral coats removed from the bacteria.

↓

Centrifugation : Viral particles separated from the bacterial cell.

↓	↓
No radioactive (35_S) detected in bacterial cells but detected in supernatant	Radioactive (35_P) detected in baterial cells but not in supernatant

Conclusion : DNA is the genetic material.

Meselson and Stahl's Experiment :

- Meselson and Stahl performed the experiment in 1958 on *E.coli* to prove that DNA replication is semiconservative.
- *E.coli* was grown in $15NH_4Cl$ for many generations.
- 15N was incorporated into newly synthesised DNA.
- This heavy DNA could be differentiated from normal DNA by centrifugation in cesium chloride (CsCl) density gradient.

- ❑ Then they transferred these *E.coli* into a medium with normal $14NH_4Cl$.
- ❑ After 20 minutes, it was found that all the DNA molecules of daughter cells were hybrid–First generation.
- ❑ After 40 minutes, it was found that 50% DNA molecules were hybrid and 50% were normal-second generation.

DNA Replication :

(i) **Origin of replication -** it is the starting point when replication of DNA begins.

(ii) **Replication fork -** for long DNA molecules, since the two strands of DNA cannot be seperated in its entire length, the replication occur within a small opening of DNA helix, referred to as replication fork.

(iii) **Continuous synthesis -** DNA dependent DNA polymerase catalyses polymerisation only in 5'→3' direction, one strand (the template with polarity 3'→5'), the replication is continuous.

(iv) **Discontinuous synthesis -** In the template with 5'→3' the replication is disecontinuous and the fragments are joined by enzyme ligase.

Transcription in Prokaryotes : In prokaryotes the process of transcription is completed in three steps:

1. ***Initiation :*** RNA polymerase binds with initiation factor (sigma factor) and then binds to promotor site.
2. ***Elongation :*** RNA polymerase separates from sigma factor and adds nucleoside triphosphate as substrate. RNA is formed during the process following the rule of coplementarity and remains bound to enzyme RNA polymerase.
3. ***Termination :*** On reaching terminator region RNA polymerase binds with rho factor (terminator factor). As a result nascent RNA separates.

Transcription in Eukaryotes :

- ❑ In eukaryotes three types of RNA polymerases found in the nucleus (apart from RNa polymerases are found in the organelles) are involved in transcription.

  RNA Polymerase I : Transcribes rRNAs.

  RNA Polymerase II : Transcribes hnRNA (which is precursor of mRNA).

  RNA Polymerase III : Transcribes tRNA, 5 srRNA and snRNA.
- ❑ The primary transcript has both exon and intron regions.
- ❑ Introns which are non-coding regions removed by a process called splicing.

- hnRNA undergoes two additional processes :

  (a) **Capping :** An unusual nucleotide (methylguanosine triphosphate) is added to 5'–end of hnRNA.

  (b) **Tailing :** Adenylate residues (200-300) are added at 3'–end.

  It is fully processed hnRNA, now called mRNA is transported out of the nucleus

Lac Operon

- The concept of operon was proposed by Jacob Monod. Operon is a unit of prokaryotic gene expression.
- The lac operon consists of one regulatory gene (the i-gene) and three structural genes (z, y and a).
- The i-gene codes for repressor of lac operon.
- Lactose is an inducer.
- Gene Z - Codes for β-galactosidase

  Gene Y - Codes for permease

  Gene A - Codes for transacetylase.

In the absence of Inducer (lactose)

Repressor (i-gene) binds with operator (o)

↓

Operator turns off

↓

RNA polymerase stops the transcription

↓

Structural genes (z, y and a) do not produce lac mRNA and enzymes

In the presence of Inducer (lactose)

Repressor binds to inducer (lactose)

↓

Operator (o) turns ON

↓

RNA polymerase starts the transcription

↓

Structural genes (z, y and a) produce mRNA and enzymes (β-galactosidase, permease and transacetylase respectively)

Packaging of DNA Helix

- The average distance between the two adjacent base pairs is 0.34 nm (0.34×10^{-9}m or 3.4˚A)
- The number of base pairs in *E.coli* is 4.6×10^6.
- **DNA Packaging in Prokaryates -** DNA is not scattered throghout the cell. DNA (negatively charged) is held by some proteins (has positive charges) in a region termed as 'nucleoid'. The DNA in nucleoid is organised in large loops held by proteins.
- **DNA packaging in Eukayotes -** There is a set of positively charged basic proteins called histones. Histones are rich in the basic amine and residues lysines and arginines.
- Histones are organised to form a unit of eight molecules called histone octamer.
- The negatively charged DNA is wrapped around positively charged histone octamer to form a structure called nucleosome
- Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin
- The beads-on-string structure in chromatin is packaged to form chromatin fibres that are futher coiled and condensed at metaphase stage of cell division to form chromosomes
- The packaging of chromatin at higher level requires additional set of protein that collectively are referred to as Non-histone chromosomal (NHC) proteins. At places chromatin is density packed to form darkly staining heterochromatin. At other places chromatin is loosely packed to form euchromatin

Genetic Code

(i) The codon is triplet 61 codons code for amino acids and 3 codons function as stop codons (UAG, UGA, UAA)

(ii) One codon codes for only one amino acid, hence the codon is unambiguous and specific.

(iii) Some amino acids are coded by maore than one cadon – degenerate

(iv) The codon is read in mRNA in a contiguous fashion. There are no punctuations

(v) The code is nearly universal

(vi) AUG has dual functions. It codes for Methionine (met) and it also acts as initiator codon.

tRNA–the Adapter Molecule :

- tRNA has an anticoden loop that has bases complementary to the code and also has an amino acid accepter end through which it binds to amino

acids.

Translation :

- Translation refers to the process of polymerisation of amino acids to form a polypeptide. The order and requence of amino acids are defined by the sequence of bases in the mRNA.
- First step is - charging of tRNA or aminoacylation of tRNA-here amino acids are activated in the presence of ATP and linked to specific tRNA.
- Initiation - Ribosome binds to mRNA at the start codon (AUG) that is recognised by the initiator tRNA.
- **Elongation phase -** Here complexes composed of an amino acid linked to tRNA, sequentially bind to the appropriate codon in mRNA by forming complementary base pairs with tRNA codon. The ribosomes move from codon to codon along with the mRNA. Amino acids are added one by one, translated into polypeptide sequences.
- **Termination -** Release factors binds to the stop codon, terminating translation and releasing the complete polypetide from the ribosome.
- **Human Genome Project** was a 13 year project coordinated by the U.S. Department of energy and National Institute of Health, It was completed in 2003.

Important goals of HGP

(i) Identify all the apponimately 20,000-25,000 genes in human DNA.

(ii) Determine the sequences of the 3 million chemical base pairs that make up human DNA.

(iii) Store this information in database.

(iv) Transfer related technologies to other sectors, such as industries.

(v) Address the ethical, legal and social issues (ELSI) that may arise from the project.

Salient Features of Human Genome - Refer Pg - 120, NCERT Class XII)

DNA Fingerprinting - is a technique of determining nucleotide sequences of certain areas of DNA which are unique to each individual

Principle of DNA Fingerprinting - Short nucleotide repeats in the DNA are very specific in each individual and vary in number from person to person but are inherited. These are 'Variable Number Tandem Repeats' (VNTRs). Each individual inherits these repeats from his/her parents which is used as genetic markers. One half of VNTR alleles of the child resembles that of the mother and other half the father.

Steps/procedure in DNA fingerprinting –

– Extraction of DNA - using high speed refrigerated centrifuge.

– Amplification - many copies are made using PCR

– Restriction Digestion - using restriction enzymes DNA is cut into fragments.

– Separation of DNA fragments - using electrophoresis-agarose polymer gel.

– Southern Blotting : Separated DNA sequences are transferred onto nitrocellulose or nylon membrane.

– Hybridisation : The nylon memberane exposed to radio active probes.

– Autoradiography : The dark bands develop at the probe site.

Applications of DNA Fingerprinting

(i) identify criminals in forensic labs.

(ii) determine paternety

(iii) verify whether a hopeful immigrant is really close relative of an already established resident.

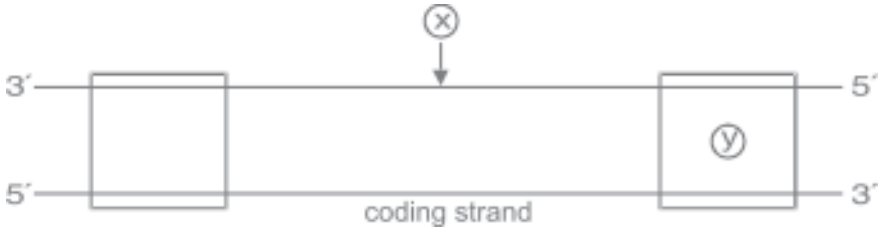
(iv) identify racial graps to rewrite biological evolution.

QUESTIONS

VSA (1 MARK)

1. Name the factors for RNA polymerase enzyme which recognises the start and termination signals on DNA for transcription process in Bacteria.
2. Mention the function of non-histone protein.
3. During translation what role is performed by tRNA
4. RNA viruses mutate and evolve faster than other viruses. Why?

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



6. Mention the dual functions of AUG.
7. Write the segment of RNA transcribed from the given DNA –

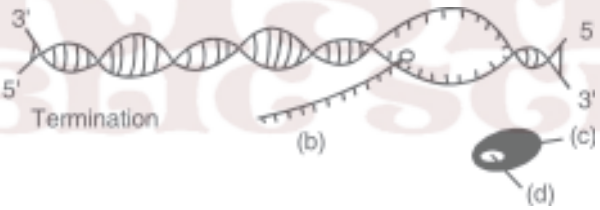
   3′ – A T G C A G T A C G T C G T A – 5′ – Template Strand

   5′ – T A C G T C A T G C A G C A T – 3′ – Coding Strand.

SA-II (2 MARKS

8. The process of termination during transcription in a prokaryotic cell is being represented here. Name the label a, b, c and d.

(a)



9. Complete the blanks a, b, c and d on the basis of Frederick Griffith Experiment.

   S Strain → inject into mice → (a)

   R strain → inject into mice → (b)

   S strain (heat killed) → inject into mice → (c)

   S strain (heat killed) + R strain (live) → inject into mice → (d)

10. Give two reasons why both the strands of DNA are not copied during transcription.
11. Mention any two applications of DNA fingerprinting.
12. State the 4 criteria which a molecule must fulfill to act as a genetic material.

SA-I (3 MARKS)

13. Give six points of difference between DNA and RNA in their structure/ chemistry and function.
14. Explain how does the hnRNA becomes the mRNA.

OR

Explain the process of splicing, capping and tailing which occur during transcription in Eukaryotes.

15. Name the three major types of RNAs, specifying the function of each in the synthesis of polypeptide.
16. Enlist the goals of Human genome project.
17. A tRNA is charged with the amino acid methionine.
    (i) Give the anti-codon of this tRNA.
    (ii) Write the Codon for methionine.
    (iii) Name the enzyme responsible for binding of amino acid to tRNA.
18. Illustrate schematically the process of initiation, elongation and termination during transcription of a gene in a bacterium.

LA (5 MARKS)

19. What is meant by semi conservative replication? How did Meselson and Stahl prove it experimentally?
20. What does the lac operon consist of? How is the operator switch turned on and off in the expression of genes in this operon? Explain.
21. State salient features of genetic code.
22. Describe the process of transcription of mRNA is an eukaryotic cell.
23. Describe the various steps involved in the technique of DNA fingerprinting.

ANSWERS

VSA (1 MARK)

1. Sigma (σ) factor and Rho(p) factor)
2. Packaging of chromatin
3. (i) Structural role
   (ii) Transfer of amino acid.

4. –OH group is present on RNA, which is a reactive group so it is unstable and mutate faster.

5. X – Template strand, Y – Terminator.

6. (i) Acts as initiation codon for protein synthesis

   (ii) It codes for methionine.

7. 5' – U A C G U C A U G C A G C A U – 3' (In RNA 'T' is replaced by 'U')

SA-II (2 MARKS)

8. (a) DNA molecule (b) mRNA transcript

   (c) RNA polymers (d) Rho factor

9. (a) Mice die (b) mice live

   (c) mice live (d) mice die

10. (a) If both the strands of DNA are copied, two different RNAs (complementary to each other) and hence two different polypeptides will produce; If a segment of DNA produces two polypeptides, the genetic information machinery becomes complicated.

    (b) The two complementary RNA molecules (produced simultaneously) would form a doublestranded RNA rather than getting translated into polypeptides.

    (c) RNA polymerase carries out polymerisation in 5' – 3' direction and hence the DNA strand with 3' – 5' polarity acts as the template strand. (Any two)

11. (i) To identify criminals in the forensic laboratory.

    (ii) To determine the real or biological parents in case of disputes.

    (iii) To identify racial groups to rewrite the biological evolution. (Any two)

12. (i) It should be able to generate its replica.

    (ii) Should be chemically and structurally stable.

    (iii) Should be able to express itself in the form of Mendelian characters.

    (iv) Should provide the scope for slow changes (mutations) that are necessary for evolution.

SA-I (3 MARKS)

13.

	DNA		RNA
(i)	Double stranded molecules	(i)	Single stranded molecules
(ii)	Thymine as pyrimidine base	(ii)	Uracil as pyrimidine base
(iii)	Pentose sugar is Deoxyribose	(iii)	Sugar is Ribose
(iv)	Quite stable and not very reactive	(iv)	2´-OH makes it reactive
(v)	Dictates the synthesis of Polypeptides	(v)	Perform their functions in protein synthesis.
(vi)	Found in the nucleus.	(vi)	They are transported into the cytoplasm.

14. hnRNA is precursor of mRNA. It undergoes

(i) **Splicing :** Introns are removed and exons are joined together.

(ii) **Capping :** an unusual nucleotide (methyl guanosine triphosphate is added to the 5´ end of hnRNA.

(iii) Adenylate residues (200-300) are added at 3´ end of hnRNA.

OR

Refer fig. 6.11, page 110, NCERT book. Biology - XII

15. (i) **mRNA-(Messenger RNA) :** decides the sequence of amino acids.

(ii) **tRNA-(Transfer RNA) :** (a) Recognises the codon on mRNA (b) transport the aminoacid to the site of protein synthesis.

(iii) **rRNA (Ribosomal RNA) :** Plays the structural and catalytic role during translation.

16. Refer points given on page 118, NCERT, Biology XII.

17. (a) UAC (b) AUG (c) Amino-acyltRNA synthetase.

18. Refer figure 6.10, page 109, NCERT Biology XII.

LA (5 MARKS)

19. Meselson and Stahl, performed an experiment using *E.coli* to prove that DNA replication is semi conservative.

– They grew *E.coli* in a medium containing $^{15}NH_4Cl$.

– Then separated heavy DNA from normal (14N) by centrifugation in CsCl density gradient.

- The DNA extracted, after one generation of transfer from 15N medium to 14N medium, had an intermediate density.
- The DNA extracted after two generations consisted of equal amounts of light and hybrid DNA.
- They proved that DNA replicates in a semiconservative manner. (Refer figure 6.7, page 105, NCERT Biology XII).

20. Lac Operon consists of the following :
    - **Structural genes :** z, y, a which transcribe a polycistronic mRNA.
    - gene 'z' codes for β-galactosidase
    - gene 'y' codes for permease.
    - gene 'a' codes for transacetylase.
    - **Promotor :** The site where RNA polymerase binds for transcription.
    - **Operator :** acts as a switch for the operon
    - **Repressor :** It binds to the operator and prevents the RNA Polymerase from transcribing.
    - **Inducer :** Lactose is the inducer that inactivates the repressor by binding to it.
    - Allows an access for the RNA polymerase to the structural gene and transcription.
    - Refer figure 6.14, page 117, NCERT, Biology XII.
21. Refer notes
22. Refer notes 35 and figure 6.11, page 110, NCERT Biology XII.
23. Refer points to remember – Steps involved in DNA fingerprinting

CHAPTER 7

EVOLUTION

POINTS TO REMEMBER

Artificial Selection : It is the process carried out by man to select better breeds of plants and aminals.

Bio-geography : The study of patterns of distribution of plants and aminals in different parts of earth.

Founders Effect : A genetic drift in human population where a population in a new settlement have different gene frequency from that of the parent population. The original drifted population said to be founder.

Gene Pool : Sum total of all the genes in a population.

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

Panspermia : Units of life in the form of so called spores, which were transferred to earth from outer space (as believed by some scientists).

Saltation : Single step large mutations.

Speciation : It is the formation of new species from the pre-existing ones.

Organic (Biological) Evolution : Changes in the characteristics/features of organisms or groups of such populations over a number of generations.

Homologous organs : These have same basic structure and embryonic origin but perform different functions in different species.

Analogous organs : These organs are different in their basic structure and embryonic origin but perform similar functions.

Human Evolution : *Ramapithecus* → *Australopithecus* → *Homo habilis* → *Homo erectus* → *Homo sapiens* → *Homo sapiens sapiens.*

The Theories of Origin of Life

1. **Theory of Special Creation :** According to this theory God has created life within 6 days.

2. **Theory of Spontaneous Generation :** According to this theory life originated from decaying and rotting matter like straw and mud.

3. **Panspermiatic Theory :** According to this theory life come from space in the form of spores called 'Panspermia'.

4. **Modern Theory or Oparin-Haldane Theory :** According to this theory life originated upon earth spontaneously from non-living matter. First inorganic compounds then organic compounds were formed in accordance with ever changing environmental conditions. This is called chemical evolution. The conditions on earth were – high temperature, volcanic storms, reducing atmosphere (without free oxygen) containing methane and ammonia.

Experimental Evidence for Abiogenesis (Miller's Experiment) : Stanley Miller in 1953 demonstrated in a laboratory that electric discharges can produce complex organic compounds from a mixture of methane, ammonia, water vapours and hydrogen. In his experiment he found that simple organic compounds including some amino acids are formed. In similar experiments others observed the formation of sugar, nitrogen bases, fats and pigments.

Divergent evolution : It shows relationship of structures having same origin but perform different functions. It is called homology. Examples : (i) Wings of a bird, forelimbs of horse, flippers of whale. (ii) Thorns of Bougainvillea and tendrils of cucurbita.

Convergent evolution : This shows the relationship of structures having functional similarities but different origin. It is called analogy. Examples : (i) Wings of insects and wings of bird. (ii) Sweet potato and potato.

Industrial melanism : It is an adaptation where moths living in the industrial area developed melanin pigments to match their body colour to the tree-trunk. Before Industralisation in England, it was observed that there were more white-winged moths on trees than dark-winged moths (melanised moths). After industrialisation (in 1920), there were more dark-winged moths in some areas. After industrialisation, trees got covered by smoke. So white-winged moth were picked up by the birds but dark-winged moths escaped and survived. Thus, industrial melanism supports the evolution by natural selection.

Adaptive radiation : The process of evolution of different species in a geographical area starting from a point and literally radiating to other habitats is called adaptive radiation. Examples : (i) Darwin's finches found in Galapagos island. (ii) Marsupials of Australia.

Evolution of Plants : Unicellular → Multicellular → Algae → Rhynia type plants → Cycads → Gnetales → Dicot → Monocot.

Hardy-Weinberg Principle : The allele frequencies in a population are stable and is constant from generation to generation. Sum total of all the allele frequencies is 1.

Factors Affecting Hardy-Weinberg Equilibrium : Gene migration, Genetic drift, Mutations, Recombination, Natural Selection.

Some Facts :

- ❑ The Universe is about twenty billions years old.
- ❑ Earth was formed about 4.5 billion years ago.
- ❑ Life started appearing about 4 billion years earlier.

QUESTIONS

VSA (1 MARK)

1. Name one fish like reptile that evolved from land reptile about 200 million years ago?
2. For a long time, it was believed that life originated from decaying matter. What is this theory known as? Name the scientist who experimentally disproved this theory.
3. If abiotic origin of life is in progress on a planet other than earth, what should be the conditions there?
4. Name the person who proposed that population tends to increase geometrically while food production increases arithmetically.
5. Name the scientist who had also come to similar conclusion as that of Darwin about natural selection as a mechanism of evolution. Which place did he visit to come to conclusions?

SA-II (2 MARKS)

6. Explain Oparin-Haldane theory of chemical evolution of life.
7. Distinguish between convergent and divergent evolution giving one example of each.
8. What is adaptive radiation? Explain with an example.
9. How did Louis Pasteur disprove spontaneous generation theory?

SA-1 (3 MARKS)

10. (i) State the Hardy-Weinberg principle.

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

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

11. Classify the following as examples of homology and analogy–

    (i) Hearts of fish and crocodile

    (ii) Wings of butterfly and birds

    (iii) Eyes of Octopus and Mammals

    (iv) Tubers of potato and Sweet potato

    (v) Thorns of *Bougainvillea* and spines of Opuntia

    (vi) Thorn of *Bougainvillea* and tendrils of cucurbits.

12. Stanley Miller and Harold Urey performed an experiment by recreating in the laboratory the probable conditions of the atmosphere of the primitive earth.

    (i) What was the aim of the experiment?

    (ii) In what forms was the energy supplied for chemical reactions to occur?

    (III) For how long was the experiment run continuously? Name two products formed.

13. 'Industrial Melanism' in peppered moth is an excellent example of 'Natural selection'. Justify the statement.

14. Fill up the blanks left in the table showing Era, period and organism.

Era	Period	Organisms
Cenozoic	a	Modern man, Mammals, Birds, rise of monocot
b	Tertiary	Rise of first Primate, angiosperm
Mesozoic	c	Gingko, Gnetales
d	Jurassic	Conifers, cycads, Reptiles
Paleozoic	e	Early reptiles (extinct)
f	Silurian	Psilophyton

15. (i)In which part of the world, Neanderthal man lived?

    (ii)What was his brain's capacity?

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

16. Figures given below are of Darwin's finches?

Variety of beaks of Darwin's finches.

(a) Mention the specific geographical area where these were found.

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

(c) How did Darwin visit the particular geographical area?

17. Give examples to show evolution by anthropogenic action.

LA (5 MARKS)

18. Is evolution a 'process' or the end result of a 'process'? Discuss. Describe various factors that effect Hardy-Weinberg equilibrium.

19. How do Darwin and Hugo de Vries after regarding Mechanism of Evolution?

20. With the help of suitable diagram, represent the operation of natural selection on different traits.

ANSWERS

VSA (1 MARK)

1. **Ichthyosaurs.**

2. Theory of Spontaneous generation; Louis Pasteur.

3. Very high temperature, volcanic storms, Reducing atmosphere containing CH_4, NH_3, H_2 and water vapours.

4. Thomas Malthus.

5. Alfred Wallace, Malay Archipelago

6. The first life form could have come from the pre-existing, non-living organic molecules (like RNA, Proteins, etc.) and the formation of life was preceded by chemical evolution.

7. Refer page 130, 131, NCERT Text book, Biology - XII

8. Refer page 133, NCERT book, Biology - XII

9. Louis Pasteur showed that in pre-sterilized flasks, life did not come from killed yeast while in another flask open to air, new organisms arose from 'killed yeast.

SA-I (3 MARKS)

10. (i) The allele frequency in a population are stable and constant from generation to generation.

    (ii) Evolution.

    (iii) One.

11. (i) Homology (ii) Analogy (iii) Analogy (iv) Analogy

    (v) Analogy (vi) Homology

12. (i) To prove Oparin's theory of origin of life.

    (ii) Electric discharge using electrodes.

    (iii) One week; Amino acids and Sugar.

13. Refer Page 131, NCERT Text book of class XII.

14. (a) Quaternary (b) Coenozoic (c) Cretaceous

    (d) Mesozoic (e) Carboniferous (f) Paleozoic

15. (i) Near Eastern and Central Asia

    (ii) 1400 c.c.

    (iii) More brain capacity, use of hides to cover body and burial of dead.

16. (a) Galapagos Island.

    (b) Adaptive radiation – Refer page 133, NCERT book.

    (c) Through sea voyage in a sail ship called H.M.S. Beagle.

17. Excess use of herbicides pesticides etc. has resulted in selection of resistent varieties in a much lesser time scale. Same is true for antibiotic or drug resistant microbes.

LA (5 MARKS)

18. Refer page 135, NCERT Text book, Biology - XII

19. Darwin : Darwinian variatious are gradual, small and directional

    Hugo deVries : put forth idea of mutations, mutations are sudden random and directional

20. Refer page No. 136, NCERT Text book of class XII.

CHAPTER 8

HUMAN HEALTH AND DISEASE

POINTS TO REMEMBER

Carcinogens : Cancer causing agents. e.g., gamma rays. UV rays, dyes and lead.

Immunity : Resistance to infection or antigen.

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

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

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

Metastasis : The property in which the cancer cells spread to different sites through blood and develop secondary tumors.

Oncogenes : Viral genome which causes cancer.

Retrovirus : A virus having RNA as genetic material and forms DNA by reverse transcription and then replicate e.g., Human Immunodeficiency Virus (HIV).

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

Syndrome : Collection of disease symptoms responsible for a disorder or a disease.

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

ABBREVIATIONS

PMNL : Polymorpho-Nuclear Leukocytes

CMI : Cell Mediated Immunity

ELISA : Enzyme Linked Immunosorbent Assay

HLA : Human Leukocyte Antigen

MALT : Mucosal Associated Lymphoid Tissue

SCID : Severe Combined Immuno Deficiency

NACO : National AIDS Control Organisation

MRI : Magnetic Resonance Imaging

– **Health –** The state of complete physical, mental and social well beings

– Good health can be achieved by (i) awareness about disease and their effects on different body functions. (ii) vaccination (iii) control of vectors (iv) proper disposal of wastes (v) Maintenance of hygienic food and water resources.

– **Infectious Diseases** (i) Viral Diseases eg. polio, common cold, measles, rabies (ii) Bacterial diseases – eg. Typhoid, pneumonia, Diptheria, Tetanus, (iii) Fungal diseases - eg. Ring worm & Scabies (v) Helminthic diseases - eg Ascariasis, Filariasis, Taeniasis

	Disease	Causative Agents	Symptoms
1.	Common cold	Rhinoviruses	Nasal congestion and discharge, sore throat cough, headache, tiredness and hoarseness.
2.	Typhoid	*Salmonella typhi*	sustained high fever, stomach pain, loss of appetite, constipation, headache.
3.	Pneumonia	*Streptococcus pneumoniae* and *Haemophilus* influenzae	fever, headache, cough, chills' in severe cases finger nails may turn grey to bluish in colour.
4.	Malaria	*Plasmodium P. malaria, P.vivax, P. falciparum*	yawning, tiredness, acute headache, muscular pain, feeling of chillness and shivering, nausea and high temperatures
5.	Amoebic dysentry	*Entamoeba* histolytica	Abdominal pain, cramps, stool with excess mucus and blood clots, constipation

6.	Ringworm	*Microsporum epidermophyton* and *trichophyton*	Dry scaly lesions on skin, nails and scalp, itching
7.	Ascariasis	*Ascaris lumbricoides*	Anaemia, muscular pain, internal bleeding, insomnia, blockage of intestinal passage
8.	Filariasis or Elephantiasis	*Wuchereria bancrofti* and *W. malayi*	fever, blockage of lymphatic vessels, enormous swelling of affected part viz. arm, foot, leg, mamma or scrotum

Two types of immunities –

(i) **Innate immunity –** in-herited by the organism from the parents and protects from birth through out life.

Four types of barriers

(a) **Physical** - eg skin, mucus coating epithelium of respiratory, gastro-intestinal and urinogenital tracts.

(b) **Physiological -** eg. acid of stomach, lysozymes of saliva and tears

(c) **Cellular** eg. PMNL, monocytes, Neutrophils and macrophages

(d) **Cytokine** - eg virus infected cells secrete proteins called interferons which protect non-infected cells from further infection

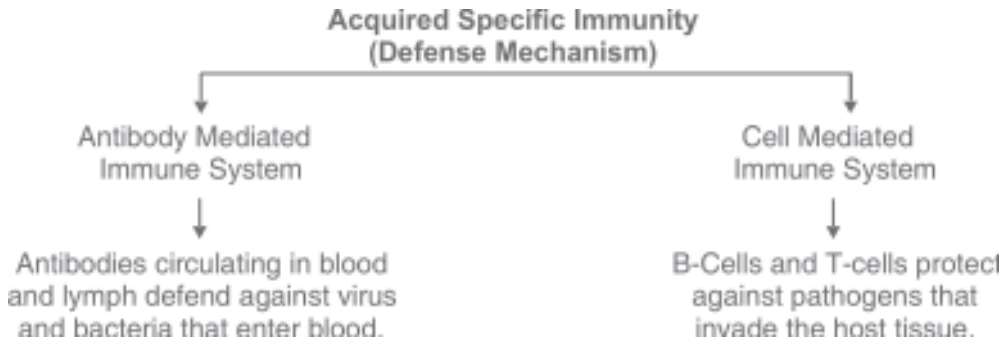
(ii) **Acquired Immunity –** Acquired by a person after birth by vaccination or contacting the disease.

FACTORS AFFECTING HEALTH

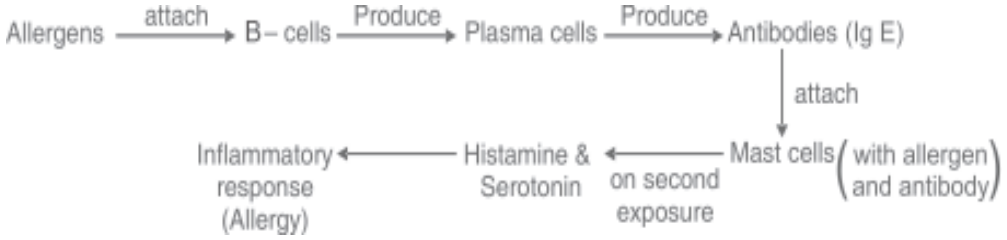
(a) **Genetic :** Child may inherit certain disorders from parents.

(b) **Life Style :** Water/food intake, rest, exercise, personal hygiene.

(c) Infection and Corresponding immunity.



- ❑ It is based on the principle of memory and immunity.
- ❑ The antigenic preparations of proteins of pathogens or a solution of inactivated or weakened pathogens are introduced in the body.
- ❑ The antigenic properties are recognised.
- ❑ Cascade of reactions forms antibodies
- ❑ History of reactions is stored as memory.
- ❑ Subsequent exposures result in intensified response.



Drugs

Criteria	*Opiods*	*Cannabinoids*	*Coca alkaloids*
Source	Papaver sominiferum (Popply Plant)	Cannabis sativa (Hemp Plant)	Erythroxylum coca (Coca plant)
Part of Plant	Fruits (Unripen Capsules)	Inflorescence, leaves, resin	Leaves and Young twigs
Product	Opium, Morphine Heroin/Smack	Charas, Ganja Hashish Marijuana	Cocaine (Coke/ Crack)
Mode of Intake	Snorting, Injection	Oral, Inhalation	Snorting
Effects (Property)	Neuro depressant, Slow down the functions of the body	Interact with cannabinoid receptors, Cardiovascular system effects	Sense of euphoria interferes with neurotransmitters, Hallucination

– **Acquired Immunity**

  (i) May be Humoral (containing antibodies which circulate in body fluids). mediated by B–lymphocytes.

  (ii) Cell-Mediated (CMI) - mediated by T-lymphocytes

– Acquired immunity may be active or passive.

– Vaccination and immunisation are based on the property called 'memory' of the immune systems.

– **Symptoms of Allergy –** Sneezing, watery eyes, rashes, running nose and difficulty in breathing.

– **Auto Immunity –** When the immune system of body starts distroying 'self' cells and molecules, called auto immune diseases eg Rheumatoid arthritis, multiple sclerosis and insulin-dependent diabetes.

– Immune system in the body play an important role in organ transplantation, allergic reactions and auto immune diseases

– Immune system consists of lymphoid organe, bone marrow, thymus, spleen, lymph nodes and MALT (Mucosal Associated Lymphoid Tissue)

AIDS - (Acquired Immuno Dificiency Syndrome)

– caused by HIV (Human Immunodeficiency Virus) which belongs to retrovirus category of viruses.

Modes of transmission

– By sexual contact with infected person

– By transfusion of contaminated blood and blood products

– By sharing the infacted needles

– From infected mother to child through placenta

Persons who are at high risk of getting infection include-

– Individuals who have multiple sex partners

– Drug addicts taking drugs intravenously

– Individuals who require repeated blood transfusions

– Children born to HIV infected mother

Prevention of AIDS

– Using disposal syringes and needles, checking the blood of HIV, controlling drug abuse, free distribution of condoms and advocating safe sex.

– Main test for AIDS in ELISA (Enzyme Linked Immuno Sorbant Assay)

Cancer

– Carcinogens induce the transformation of normal cells into cancerous cells eg. UV rays, X-rays, Υ-rays, anilene dyes and tumour viruses, cadmium oxide, mustard gas, Ni & Cr compounds etc

Two types of tumors – (a) **Benign** – confined to the area of formation and do not spread to other parts. (b) **Malignant** - show metastasis ie. cells

of these tumors can be carried by blood stream or lymph to other parts of body and form secondaries in neighbouring organs.

Treatment – through surgery, radiotherapy, chemotherapy, immunotherapy.

QUESTIONS

VSA (1 MARK)

1. Name the diagnostic test which confirms typhoid.
2. Name the two major groups of cells required to attain specific immunity.
3. You have heard of many incidences of Chickengunya in our country. Name the vector of the disease.
4. Breast fed babies are more immune to diseases than the bottle fed babies. Why?
5. Name the pathogen which causes malignant malaria.
6. Which microorganism is used to produce hepatitis B Vaccine?
7. What is the reason of shivering in malarial patient?

SA-II (2 MARKS)

8. Where are B-cells and T-cells formed? How do they differ from each other?
9. Given below are the pathogens and the diseases caused by them. Which out of these pairs is not correct matching pair and why?
   (a) *Wuchereria* – Filariasis
   (b) *Microsporum* – Ringworm
   (c) *Salmonella* – Common Cold
   (d) *Plasmodium* – Malaria
10. What would happen to the immune system, if thymus gland is removed from the body of a person?
11. Lymph nodes are secondary lymphoid organs. Describe the role of lymph nodes in our immune response.
12. What is the role of histamine in inflammatory response? Name few drugs which reduce the symptoms of allergy.

SA-I (3 MARKS)

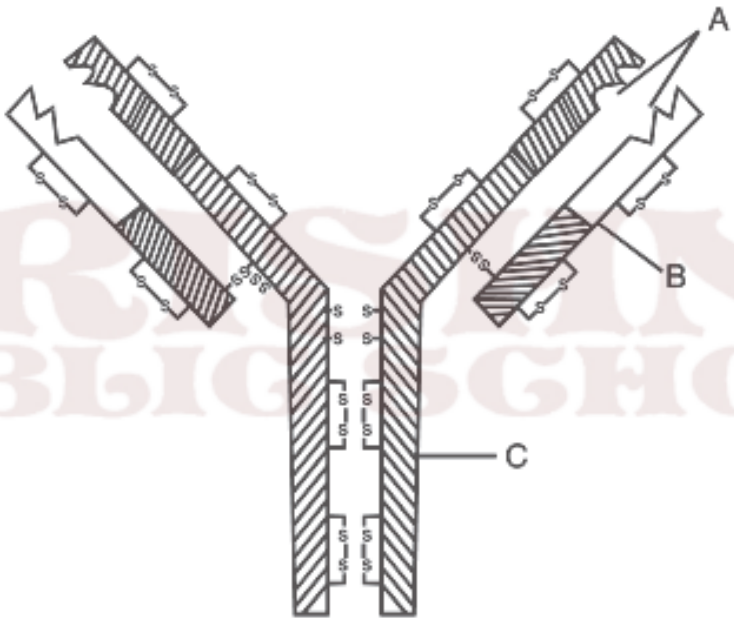
13. What are Cannabinoids? From which plant Cannabinoids are obtained? Which part of the body is affected by consuming these substances?

14. In the figure, structure of an antibody molecule is shown. Observe it and Give the answer of the following questions.

    (i) Label the parts A, B and C.

    (ii) Which cells produce these chemicals?

    (iii) State the function of these molecules.



15. Mention any three causes of drug abuse. Suggest some measures for the prevention and control of drug abuse.

15. A person shows unwelcome immunogenic reactions while exposed to certain substances.

    (a) Name this condition.

    (b) What common term is given to the substances responsible for this condition?

    (c) Name the cells and the chemical substances released which cause such reactions.

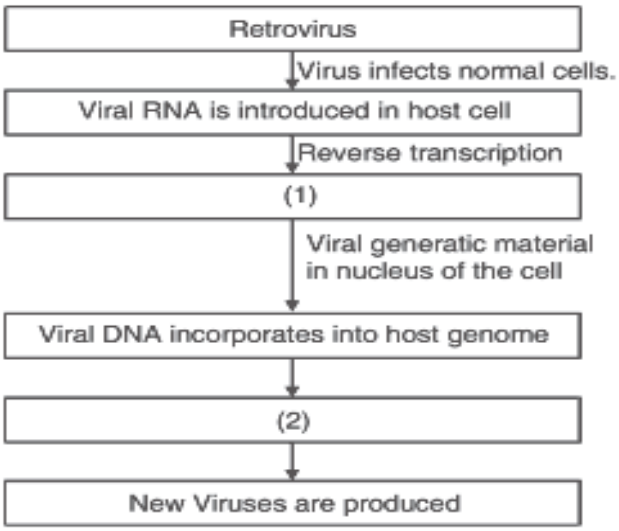
17. Fill in the blanks in the different columns of the table given below to identify the nos 1 to 6.

	Name of disease	***Causative organism***	***Symptoms***
1.	Pneumonia	*Streptococcus*	(1)
2.	Typhoid	(2)	High fever, weakness, headache, stomach pain
3.	(3)	*Rhinoviruses*	Nasal Congestion, and discharge sorethroat cough, headache
4.	Ascariasis	*Ascaris*	(4)
5.	Ringworm	(5)	Dry, Scaly lesions on various body parts, Intense itching, redness.
6.	(6)	*Entamoeba histolytica*	Constipation, cramps, abdominal pain, Stools with excess mucous and blood clots.

18. In the given flow diagram, the replication of retrovirus in a host cell is shown. Examine it and answer the following questions

(a) Why is virus called reterovirus? (b) Fill in (1) and (2)

(c) Can infected cell survie while viruses are being replicated and released by host cell?



19. What is innate immunity? List the four types of barriers which protect the body from the entry of the foreign agents.

LA (5 MARKS)

20. Answer the following with respect to Caner.
    (a) How does a cancerous cell differ from a normal cell?
    (b) Benign tumor is less dangerous than malignant tumor. Why
    (c) Describe causes of cancer.
    (d) mention two methods of treatment of the disease.
21. The pathogen of a disease depends on RBCs of human for grwoth and reproduction. The person with this pathogen suffers with chill and high fever.
    (a) Identify the disease.
    (b) Name the pathogen.
    (c) What is the cause of fever?
    (d) Represent the life cycle of the pathogen diagrammatically.
22. The immune system of a person is supressed. He was found positive for a pathogen in the diagnostic test ELISA.
    (a) Name the disease, the patient is suffering from.
    (b) Which pathogen is identified by ELISA test?
    (c) Which cells of the body are attacked by the pathogen?
    (d) Suggest preventive measure of the infection.

ANSWERS

VSA (1 MARK)

1. Widal test
2. B-lymphocytes and T-lymphocytes.
3. *Aedes* mosquitoes.
4. The mother's milk consists of antibodies (Ig A) such antibodies are not available to bottle fed babies.
5. *Plasmodium falciparum.*

6. Yeast.

7. After sparozoite infection, when RBC ruptures, a toxic substance haemozoin is released which cause chilling and high fever.

SA-II (2 MARKS)

8. B-cells and T-cells are formed in bone marrow. B-cells produce antibodies but E-cells do not produce antibodies but help B-cells to produce them.

9. *Salmonella :* Common cold is not a matching pair.

10. T-lymphocytes are developed and matured in thymus gland, Immune system will become weak on removal of thymus gland.

11. Lymph nodes provide the sites for interaction of lymphocytes with the antigen. When the microorganisms enter the lymph nodes, lymphocytes present there are activated and cause the immune response.

12. Histamine acts as allergy-mediator which cause blood vessels to dilate. It is released by mast cells. Antihistamine steroids and adrenaline quickly reduce the symptoms of allergy.

SA-I (3 MARKS)

13. – Cannabinoids are a group of chemicals which interact with Cannabinoid receptors present
    – Principally in the brain Cannabinoids are obtained from the inflorescences of the plant *Cannabis sativa*.
    – The substances affect the cardiovascular system adversely

14. (a) A-Antigen binding site B-Light chain
    (b) B-lymphocytes.
    (c) Heavy Chain
    (d) Antibodies provide acquired immune response.

15. ❑ **Reasons to attract towards drug abuse :** Curiosity, peer pressure, escape from frustation and failure, family problems, false belief of enhanced performance.

❑ **Preventive measures :**

– Avoid undue peer pressure

– Education and Counselling

– Seeking help from parents and peers.

– Looking for danger signs

– Seeking professional and medical help

16. (a) Allergy (b) Allergens

(c) Mast Cells – Histamine, Serotonin

17. (i) Alveoli filled with fluid, reduced breathing, fever, chills, cough and headache.

(ii) *Salmonella typhi*

(iii) Common Cold

(iv) Internal bleeding, muscular pain, anaemia, fever and blockage of the intestinal passage.

(v) Microsporum species/Trichophyton species/Epidermophyton Species.

(vi) Amoebiasis/amoebic dysentery

18. (a) HIV has RNA genome. It produces DNA by reverse transcription.

(b) 1 : Viral DNA is produced by reverse transcriptase.

2 : New Viral RNA is produced by the infected cell.

(c) Infected cell can survive.

19. Innate Immunity is non-specific type of defense that is present at the time of birth.

(i) **Physical Barriers :** Skin, mucous-coated epithelium or respiratory, digestive and urinogenital tract.

(ii) **Physiological Barriers :** Acidity of Stomach, lysozyme in saliva, tears, sweat.

(iii) **Cellular Barrier :** Macrophages, neutorophils, monocytes and natural killer lymphocytes..

(iv) **Cytokine Barriers :** Interferons produced by Viral infected cells, protect the non-infected cells from further Viral infection.

20. (a) In normal cells, growth and differentiation is highly controlled and regulated (contact inhibition). The cancerous cells have lost the property of contact inhibition, hence continue to divide giving rise to masses of cells (tumors).

(b) The benign tumor remains confined in the organ affected as it is enclosed in a connective tissue sheath and does not enter the metastatic stage.

(c) Cancer may be caused due to carcinogens which are physical (radiations), chemicals (Nicotine, Aflatoxin, Cadmium oxide, Asbestos) and biological (viral oncogens).

(d) Surgery, radiotherapy, Chemotherapy

19. (a) Malaria

(b) Different species of Plasmodium viz P. vivax, P. Malariae and P. falciparum.

(c) Malaria is caused by the toxins (haemozoin) produced in the human body by the malarial parasite. This toxin is released by the rupturing of RBCs.

(d) Life cycle of Plasmodium : Fig. 8.1 Page 148, NCERT book, Biology - XII

20. (i) AIDS (Acquired Immuno Deficiency Syndrome)

(ii) HIV (Human Immunodeficiency Virus)

(iii) Helper T-cells, macrophages, B-lymphocytes.

(iv) **Preventive measures :**

(a) People should be educated about AIDS transmission.

(b) Disposable needles and syringes should be used

(c) Sexual habits should be changed immediately

(d) High-risk groups should be discouraged from donating blood.

(e) Routine screening may be done.

CHAPTER 9

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

POINTS TO REMEMBER

Apiculture : Rearing of honeybees for the production of honey, beewax, royal jelly and bee Venom.

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

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

Germplasm Collection : The entire collection having all the diverse alleles for all the genes in the given organism.

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

Inbreeding : Inbreeding refers to the mating of more closely related individuals within the same breed for 4-6 generations.

Out-breeding : Out-breeding is the breeding of the unrelated animals, which may be between individuals of the same breed (but having no common ancestors), or between different breeds (cross breeding or different species (interspecific hybridisation).

Super Ovulation : Stimulation of good female animal by administering hormones to produce more eggs.

Mutation breeding : Mutation in plants in induced artificially through use of mutagens to obtain desirable characters. These plants (as a source) are used in breeding.

Totipotency : The ability to generate a whole plant from any cell/explant.

ABBREVIATIONS

ET : Embryo Transfer

IARI : Indian Agricultural Research Institute

IRRI : International Rice Research Institute

ICAR : Indian Council of Agriculture Research

MOET : Multiple Ovulation Embryo Transfer

NDRI : National Dairy Research Institute

- **Animal Husbandry –** care and breeding of livestock, useful to human beings.
- **Poultry Farm Management-** Chicken and ducks and some times turkey and geese are included in poultry.
- Bee-keeping (Apiculture) (*Apis indica* is the most common species of honey bee.) Maintenance of honey bee for production of honey and wax. Honey is a food of high nutritive value.
- **Management of fisheries**
  - (i) **Fresh water fishes -** Catla, Rohu, common carp etc.
  - (ii) **Marine fishes -** Hilsa, Sardines. Mackerel and Pomfrets etc.
- **Aquaculture and Pisciculture -** The production of useful aquatic plants and animals (both freshwater and marine) like fishes, prawns lobsters and edible oysters is called 'aquaculture' while the production of fishes only is called 'pisciculture'.
- Blue-revolution is associated with fish production.
- **Out crossing -** The practice of mating of animals of same breed but have no common ancestor on either side of pedigree upto 4-6 generations. A single outcross helps to overcome the inbreeding depression.
- **Cross breeding -** The method of outbreeding in which superior males of one breed are mated with the superior females of another breed of same species.

Main steps in breeding a new genetic variety of crop

(i) Germ-plam collection or collection of variability

(ii) Evaluation and selection of parents

(iii) Cross breeding or hybridisation of selected parents.

(iv) Selection and testing of superior recombinants

(v) Testing, release and commercialisation of new cultivars.

High yielding varieties of (i) Wheat - Sonalika, kalyan sona

(ii) **Rice -** IR-8, Taichung Native-1, Jaya, Ratna, Padma etc.

(iii) **Sugar Cane -** A hybrid of *Saccharum barberi* and *S. officinarum.*

Disease of plants -

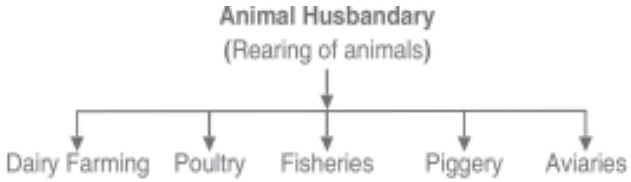
(i) **Viral -** Tobacco mosaic, turnip mosaic

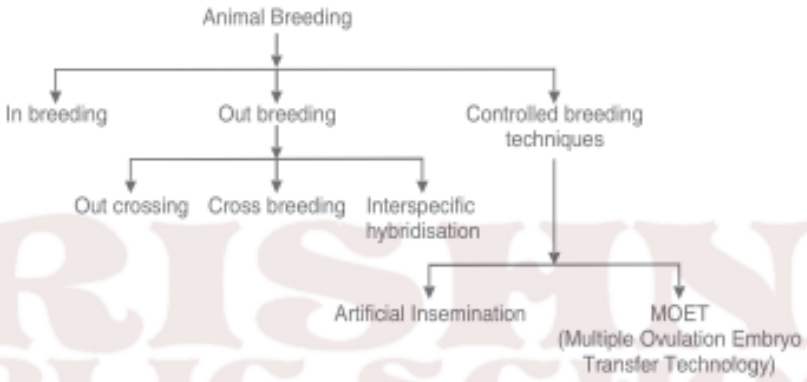
(ii) **Bacterial -** Black rot of crucifers, Blight of rice

(iii) **Fungal -** Rust of wheat, red rot of sugarcane, late blight of potato.

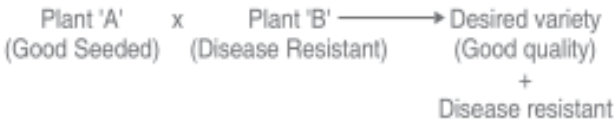
Germplasm - The sum total of all the alleles of the genes present in an individual organism and its related species

Explant - A plant part excised from a specific location in a plant to be used for initiating a culture.

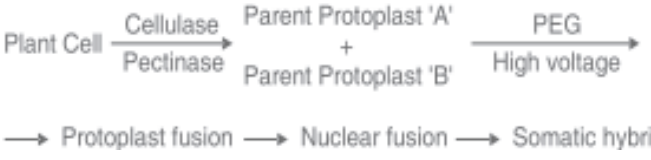




Plant Breeding for Developing Disease Resistant Varieties



Somatic Hybridisation



QUESTIONS

VSA (1 MARK)

1. Why is inbreeding necessary in animal husbandary?
2. Name two fungal diseases of Crop plants.
3. Which product of Apiculture is used in cosmetics and polishes?
4. Semi-dwarf varieties of a crop plant were derived from IR-8. Name that crop.
5. Write two qualities of *Saccharum officinarum* (Sugarcane) grown in South India.

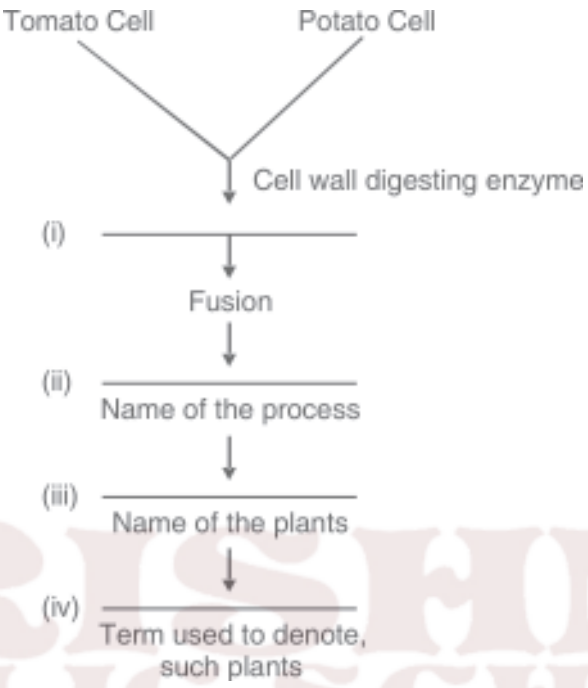
SA-II (2 MARKS)

6. A new breed of sheep was developed in Punjab by crossing two different breeds of Sheep. Name the two breeds which were crossed and the new breed developed.
7. Study the table given below and fill in the blanks marked A, B, C and D

S.No.	***Crop Variety***	***Resistant to Disease***
1. Wheat	*Himgiri*	(A)
2. *Brassica*	(B)	White rust
3. (C)	*Pusa Komal*	Bacterial blight
4. Chilli	(D)	Chilly mosaic Virus, Tobacco mosaic Virus and leaf curl

8. Why are proteins synthesized from Spirulina called Single celled Proteins? What is the significance of such a protein?
9. Differentiate between inbreeding and outbreeding in animals.

10. Observe the process of Somatic hybridisation given below and fill in the blanks. (i), (ii), (iii) and (iv)



SA I (3 MARKS)

11. What is micropropagation? Why are plants produced by this technique called somaclones? Name any two food plants which are produced on commercial scale using this method.
12. What is mutation? Explain the significance of mutation in plant breeding. Give an example of a disease resistant variety of cultivated plant induced by mutation.
13. How can we improve the success rate of fertilisation during artificial insemination in aminal husbandary programmes?
14. Biofortification is the most practical means to improve public health. Justify the statement with examples.
15. What is meant by germplasm Collection? Describe its significance in plant breeding programmes.
16. To which product, following products are related (a) Blue revolution (b) white revolution (c) Green revolution

LA-I (5 MARKS)

17. Does apiculture offer multiple advantages to farmers? List its advantages, if it is located near a place of commercial flower cultivation. Name the most common species of bee which is reared in India.

18. What is somatic hybridisation? Describe the various steps in producing somatic hybrids from protoplasts. Mention any two uses of somatic hybridisation.

ANSWERS

VSA (1 MARK)

1. Inbreeding increases homozygosity.
2. Brown rust of wheat, Smut of wheat, red rot of Sugar cane, Late blight of potato.
3. Beewax.
4. Paddy crop (rice)
5. Thicker stem and higher sugar content.

SA-II (2 MARKS)

6. By crossing Bikaneri ewes and Marino rams, the new breed Hisardale was developed.

7. A – Leaf and Stripe rust, hill bunt.
   B – *Pusa swarnim* (Karan rai).
   C – Cowpea
   D – *Pusa Sadabahar*

8. The protein rich food produced by microbes is called as single called protein (SCP) Spirulina is a microorganisms which has more protein. It is a quick method of protein production because the growth rate of microbes is enormous. Hence, it provides a protein rich diet for human beings.

9. When breeding is between animals of the same breed, it is called inbreeding, while cross between different breeds in called out breeding.

10. (i) Isolation of protoplast of Tomato cell and Potato cell.
    (ii) Somatic hybridisation.
    (iii) Pomato
    (iv) Somatic hybrid

SA-I (3 MARKS)

11. ❑ The method of producing many plants through tissue culture is called micropropagation.

    ❑ The plants produced through micropropagation will be genetically identical to the original plant from which they were grown, hence are called somaclones.

    ❑ Tomato, banana, apple are produced on commercial scale using this method.

12. **Mutation :** Sudden inheritable change in the characters of an organism due to change in the sequence of bases in the gene(s).

    ❑ Mutation results in a new character or trait, not found in the parental type

    ❑ It can also be induced by using mutagens like gamma radiations.

    ❑ Such plant materials are used as such or used for breeding new variaties.

    ❑ Mung bean resistance to yellow mosaic virus and powdery mildew.

13. The Multiple Ovulation Embryo Transfer (MOET) technology can improve the success rate of fertilisation.

    In the procedure, a cow is given hormonal treatment (FSH), so that more than one ova/eggs (6-8) are produced per cycle. After mating or artificial insemination the embryos at 8-32 celled stage, are transferred to different surrogate mother cows. This technology has been successfully used for cattle sheep, rabbit, mares and buffalloes.

14. Biofortification is the plant breeding programme designed to increase Vitamins, minerals, heigher proteins and healthier fat content in crops. This programme improves the quality of food products. It is required to prevent hidden hunger. Some of the examples of fortified crops are:

    (i) **New hybrid of maize :** has twice the amount of amino acid lysine and tryptophan.

    (ii) **Wheat :** Atlas 66, having a high protein content.

    (iii) **Rice :** 5 times iron than the normal amount. IARI Delhi has released several crops which are rich in vitamins and minerals. Consumption of such biofortified food will vastly improve the public health.

15. The collection of all the diverse alleles of all the genes of crop plant is called germ plasm collection.

    In plant breeding programmes, the germplasm provides the entire of genes

and alleles, and the characterstics which they express. The plant breeders select the most favourable characters of a particular gene and manipulate its transfer to a desirable parent.

16. (a) Fish production (b) Milk production (c) Crop production

LA (5 MARKS)

17. Apiculture or Bee-Keeping is the maintenance of hives of honeybees for the production of honey. Apiculture is beneficial for farmers in many ways. Honey bee also produces beewax which is used in industries, such as in preparation of cosmetics and polishes of various kinds. If Bee keeping is practiced in any area the commercial flowers are cultivated, it will be beneficial in the following ways.

    (i) Bees are pollinators of many crop species including flowering crops such as sunflower.

    (ii) It improves the honey yield, because honeybees collect the nectar from flowers for making honey.

    Apis indica is the msot common species whch is reared in India.

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

    Steps :

    (i) Removal of cell wall of fusing cells by digestion with a combination of pectinase and cellulase to form protoplasts.

    (ii) Fusion between protoplasts of selected parents is induced by the use of poly ethylene glycol (PEG).

    (iii) The resulted product is cultured on a suitable medium to regenerate cell walls.

    (iv) The cells obtained begin to divide to produce plantlets called somatic hybrids.

Uses/Applications :

    (i) Somaclonal variations can be created

    (ii) Lines or varieties/species of plants which can not be sexually hybridised, they can be hybridised.

    (iii) Allopolyploids can be raised by the method.

CHAPTER 10

MICROBES IN HUMAN WELFARE

POINTS TO REMEMBER

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

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

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

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

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

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

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

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

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

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

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

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

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

Prions – The proteinaceious infectious plants.

Thermal vents - The sites deep inside the geysers/ hot springs, where the average temp. is as high as 100°C.

Methanogens - Bacteria producing large quantity of methane during decomposition of organic matter.

DO : Dissolved Oxygen

GAP : Ganga Action Plan

KVIC : Khadi and Village Industries Commission

TMV : Tobacco Mosaic Virus

YAP : Yamuna Action Plan

IPM : Integrated Pest Management.

❑ Microbes includes protozoa, bacteria, fungi, microscopic plants, viruses, viroids and prions.

Microbes in household products :

Milk $\xrightarrow{\text{Lactobacillus}}$ Curd

Dough $\xrightarrow[\text{Fermentation}]{\text{Yeast}}$ Swollen, Little fermented dough

Palm sap $\xrightarrow{\text{Microbes}}$ Toddy (fermented drink)

Microbes in pruduction of Biogas

❑ Some bacteria which grow anaerobically on cellulosic material produce large amount of Methane (CH_4), along with Carbondioxide and hydrogen. These bacteria are called methanogens e.g., *Methanobacterium.*

❑ Methanogens are naturally found in rumen of cattle and sewage.

Cattle + Cellulosic food $\xrightarrow{\text{Metnanogens}}$ Partially digested cellulose + methane (CH_4)

↓

Manure + Biogas $\xleftarrow{\text{Methanogens}}$ Cattle dung (Gobar)

Microbes as Biocontrol Agents

	Microorganisms	*Catgory*	*Action*
(i)	Trichoderma Species	fungus	Kills pathogen in the root system
(ii)	Bacillus thuringiensis	bacteria	Kills the insect pest (Bt-cotton)
(iii)	Nucleopolyhedrovirus (Baculoviruses)	Virus	Kills insects and other arthropods.

Microbes as Biofertilisers

Rhizobium, Azospirillum, Azotobacter – (Bacteria) Anabaena, Nostoc, Oscillatoria (Cyanobacteria) Genus *Glomus* (Mycorrhiza).

Microbes in Industries

(a) Fermented Beverages : Saccharomyces cerevisae a yeast is used to make bread, fermented fruit juice and alcohol.

(b) Antibioitics : *Penicillium notatum*

(c) Other chemicals /enzymes/Bioactive molecules Many organic acids, enzymes are also produced by microorganisms

S.No.	*Microbe*	*Category*	*Product*
1.	*Aspergillus niger*	Fungus (Yeast)	Citric Acid
2.	*Acetobacter*	Aceti bacterium	Acetic acid (Vinegar)
3.	*Saccharomyces cerevisae*	Fungus	Ethanol
4.	*Lactobacillus*	Bacteria	Lactic acid
5.	*Streptococcus*	Batreria	Streptokinase
6.	*Clostridium butylicum*	Bacteria	Butyric acid
7.	*Monascus purpureus*	Fungus (Yeast)	Statin (Blood cholesterol lowering agent)
8.	*Trichoderma polysporum*	Fungus	Cyclosporin A (Immunosupressive agent)

Microbes in sewage Treatment

Hetrotrophic microbes present in the sewage are involved in the treatment of water. Some methanogenic bacteria are commonly found in the anaerobic sludge during sewage treatment.

QUESTIONS

VSA (1 MARK)

1. How does a small amount of curd added to fresh milk convert it into curd? Mention a nutritional quality that get added to the curd.
2. Why is secondary treatment of water in sewage treatment plant called biological treatment?
3. An antibiotic called 'Wonder Drug' was used to treat the wounded soldiers of America during World War-II. Name the drug and the scientist who discovered it.
4. You have observed that fruit juice in bottles bought from the market are clearer as compared to those made at home. Give reason.
5. Alexander Fleming discovered 'Penicillin, but its full potential as an effective antibiotic was established by other scientists. Name the two scientists.
6. Name the plant whose sap is used in making 'Toddy'. Mention the process involved in it.

SA II (2 MARKS)

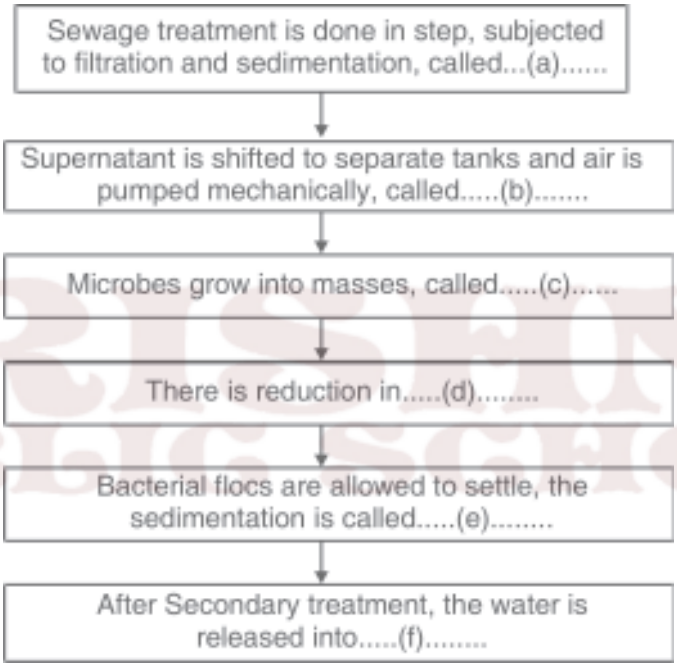
7. Name two alcoholic drinks produced in each of the following ways.
   (i) by distillation and (ii) without distillation.
8. Lactic Acid Bacteria (LAB) is commonly used in the conversion of milk into curd. Mention any two other functions of LAB that are useful to humans.
9. How do mycorrhizae function as biofertilisers? Explain with example.
10. Cyanobacteria (Nostoc, Anabaena) are used as biofertilisers in certain crop fields. Name such one crop. Also, mention the names of two other microorganisms which perform the same function.
11. Which Ministry of Govt. of India had initiated Ganga Action Plan and Yamuna Action Plan? What are the objectives of these plans?
12. Fill in the blanks spaces a, b, c, d, e, and f, given in the following table:

S. No.	***Name of Organism***	***Commercial Product***	***Application***
1.	*Penicillium notatum*	Penicillium	(a)
2.	(b)	Lactic acid	Making Curd.
3.	*Streptococcus*	Clot buster enzyme	(c)
4.	*Trichoderma polysporum*	(d)	Immuno supressive agent
5.	*Saccharomyces cerevisiae*	Ethanol	(e)
6.	(f)	Swiss cheese	Food Product

13. What is biochemical oxygen demand (BOD) test? At what stage of Sewage treatment this test is performed?

    BOD level of three samples of water labelled as A, B and C are 30 mg/L, 10mg/L and 500 mg/L respectively. Which sample of water is most polluted?

14. Given below is the Flow chart of Sewage treatment. Fill in the blank spaces marked 'a' to 'f'.



15. 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?

16. What are statins? Name the microorganism that produces this substance. How is it medically important?

LA (5 MARKS)

17. How does primary sludge differ from activated sludge? What type of changes in the sludge are carried out in anaerobic sludge digester? Give the composition of biogas produced in the sewage treatment plant.

ANSWERS

VSA (1 MARK)

1. A large number of lactic acid bacteria are found in small amount of curd which multiply and convert the milk into curd by producing the lactic acid. The nutritional quality improves by increasing Vitamin B_{12}.
2. In this treatment Organic wastes of sewage water are decomposed by certain microorganisms in presence of water.
3. Penicillin, Alexander Fleming.
4. Bottle juices are clarified by the use of pectinase and proteases.
5. Ernest chain and Howard Florey.
6. Palm tree, by fermentation.
7. (i) Whisky, brandy, rum – by distillation
   (ii) Wine, beer – without distillation
8. (i) LAB in human intestine synthesizes Vitamin B12.
   (ii) LAB in human stomach checks the growth of harmful microbes.
9. Mycorrhiza 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.
10. Peddy (Rice Crop), *Rhizobium* and Azotobacter.
11. ❑ The Ministry of Environment and Forests.
    ❑ The objective of Ganga Action Plan and Yamuna Action Plan is to save these rivers from pollution. It was proposed to build a large number of sewage treatment plants. So that only treated sewage may be discharged into these rivers.

SA-I (3 MARKS)

12. (i) to kill disease causing bacteria
    (b) Lactobacillus
    (c) remove clots from blood vessels
    (d) Cyclosporin A
    (e) Beverage/medicines
    (d) *Propionibacterium sharmanii.*

13. ❑ The BOD test measures the rate of uptake of oxygen by microorganisms in a sample of water.

    ❑ Biological treatment or Secondary treatment

    ❑ Sample 'C' is most polluted because it has highest BOD level among the three samples of water.

14. (a) Primary treatment (b) Aeration

    (c) Flocs (d) Biochemical Oxygen Demand (BOD)

    (e) Activated sludge (f) Water bodies like riverstream.

15. ❑ 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.

16. ❑ Statins are cholesterol reducing agents.

    ❑ They are produced by *Monascus purpureus* (Yeast)

    ❑ They act by Competitively inhibiting the enzymes responsible for synthesis of cholesterol and are used as blood cholesterol lowering agents.

LA (5 MARKS)

17. Primary sludge is all solids like soil, small pebbles that settle down in settling tank during primary treatment of sewage.

    Activated sluge is the sediment of bacterial 'flocs' in settling tank during biological treatment. Flocs are masses of bacteria held together by slime and fungal filaments. A part of activated sluge is used as inoculum in aeration tank and remaining is passed into a large tank called anaerobic sluge digester. In this tank, other kind of bacteria which grow anaerobically, digest the bacteria, fungi and biomass in the sludge. Biogas that produced in Sewage treatment plant is a mixture of metnane, hydrogen and Carbon dioxide.

CHAPTER 11

BIOTECHNOLOGY : PRINCIPLES AND PROCESSES

POINTS TO REMEMBER

Bacteriophage : A virus that infects bacteria.

Bioreactor : A large vessel in which raw materials are biologically converted into specific products under optimal conditions such as temperature, pH, substrate, salts, vitamins, oxygen. Stirring type bioreactors are commonly used.

Biotechnology : It deals with techniques of using live organisms (Microbes, plants animals) or components for benefit to humans.

According to EFB (European Federation of Biotechnology) : Biotechnology in the integration of natural science and organisms, cells, parts thereof and molecular analogues for products and services.

Cloning Vectors : A small, self-replicating DNA molecule into which foreign DNA is inserted. It replicates inside the host cell. The vectors that may be used in genetic engineering are plasmids, bacteriophages, animal, plant, virus, YACS and BACs and insome yeasts.

Features of cloning vector: Origin of replication (Ori), selectable marker and cloning sites are the features that are required to facilitate cloning into a vector.

(a) **Origin of Replication (Ori) :** This is a sequence from where replication starts and any piece of DNA when linked to this sequence can be made to replicate within the host cells. This sequence is also responsible for controlling the copy number of the linked DNA.

(b) **Selectable Marker :** It is a gene which helps in identifying and eliminating non-transformants from transformants (having recombinant DNA) by selectively permitting the growth of transformants. The process through which a piece of DNA is introduced in a host bacterium is called transformation. The genes encooling resistance to antibiotics are considered useful selectable marker for *E.coli*.

(c) **Cloning Sites :** A location on a cloning vector into where a foreign gene can be introduced is called a cloning site. The vector must have very few (preferably single) recognition sites. The presence of more than one recognition sites within the vector will produce several fragments which will make the process of gene cloning more complicated. Therefore, the foreign DNA is ligated at a restriction site present in one of the two antibiotic resistance gene.

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

Plasmid : Extra chromosomal, self replicating circular DNA molecule found in certain bacteria and in some yeasts. It has a few genes. Plasmids are used as cloning vectrors in genetic engineering.

Genetic Engineering : The techniques to alter the chemistry of genetic material and introduction of it into organisms to change its phenotype.

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

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

5' – GAATTC – 3'

3' – CTTAAG – 5'

Restriction Enzymes : The enzyme that cuts out a piece of DNA at a specific site. These are of two types : exonucleases and endonucleases.

Sticky ends : Single stranded portions of DNA which can form hydrogen bonds with their complementary cut DNA segments. These ends can be joined by enzyme ligase.

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

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

Tools of Recombinant DNA Technology : Restriction enzymes, polymerase enzymes, ligases, vectors, and host organisms.

Steps in Formation of rDNA by action of *Eco*RI : *Eco*RI cuts the DNA between bases G and A only → sticky ends of cut DNAs are formed → DNA fragments join at sticky ends → Recombinant DNA is formed.

Recombinant DNA (rDNA) : The hybrid DNA formed by combining DNA segment of two different organisms.

Process of Recombinant DNA Technology : Isolation of DNA → Cutting of DNA using restriction endonuclease → Amplification of Gene using PCR → Making rDNA and insertion of it into host cell/organism → obtaining the foreign gene product → Downstream processing.

(i) ***Isolation of Genetic Material (DNA) :***

- ❑ DNA can be obtained from the cell by treating with enzymes like, Lysozyme for bacteria, Cellulase for plant cell, Chitinase for fungus.
- ❑ Histone protein and RNA can be removed by treating with proteases and ribonuclease
- ❑ Purified DNA ultimately precipitated by the addition of chilled ethanol. Fine threads of DNA are obtained in the suspension.

(ii) **Cutting of DNA at specific location :** The purified DNA is cut by use of restriction enzymes. Agarose gel electrophoresis used to check the progression of restriction enzymes digestion.

(iii) **Amplification of gene of interest using PCR :** Amplification is the process of making multiple copies of desired DNA segment in *vitro*. Polymerase chain reaction involves three steps:

(a) *Denaturation :* The target DNA is heated to high temperature (94°C), resulting the separation of two strands of DNA. Each strand acts as template.

(b) *Annealing :* Two oligonucleotide primers anneal to each of the single stranded DNA template.

(c) *Extension of primers :* DNA polymerase (Taq polymerase) extends the primers using the nucleotides provided in the reaction.

(iv) **Ligation :** The cut out 'gene of interest' from the source of DNA and cut vector with appropriate space, are mixed and ligase enzyme is added. This results recombinant DNA (r-DNA).

(v) **Transfer of recombinant DNA into the host :** The ligated DNA is introduced into the recipient cell. The recipient cell makes itself 'competent' to receive and take up DNA present in the surrounding.

(vi) **Obtaining the foreign gene product :** The cell containing the foreign gene is cultured on suitable medium and the product can be extracted from the medium.

Bioreactors are used for processing large volume of culture for obtaining products of interest in sufficient quantities.

(vii) **Downstream Processing :** The products so obtained undergo a series of processes before putting them in market as a finished product. The processes include separation and purification.

The products are formulated with suitable preservation and subjected to quality control testing and clinical trials. (in case of drugs)

Essential features required to facilitate cloning into vector : Ori, Selectable marker, Recognition site, small size.

Some of the Biotechnological products and processes : rDNA vaccines, Gene therapy, Test tube babies, Synthesis of a gene and introduction of it into a target cell/organism.

Steps in creating GMO : Identification of gene of interest → Introduction of rDNA into host cell/organism → Maintenance of introduced DNA in the host and transfer of the DNA to its progeny.

Gel Electrophoresis : DNA fragments are regatively charged molecules. They can be separated by forcing them to move towards anode under an electric field through a medium. Agarose gel is used as medium. Ethidium bromide is used as stain for DNA, which on exposure to UV-light appear as orange coloured bands. Separated bands of DNA are cut out from agrose gel. This is called elution. These DNA fragments are used in recombinant DNA by joining them with cloning vectors.

QUESTIONS

VSA (1 MARK)

1. A restriction enzyme digests DNA into fragments. Name the technique used to check the progression of this enzyme and separate DNA fragments.
2. Name two commonly used vectors in genetic engineering.
3. Some enzymes are considered as molecular *scissors*. in genetic engenrring. What is the name assigned to such enzymes?
4. Write conventional nomenclature of *Eco*RI.
5. A linear DNA fragment and a plasmid has three restriction sites for *Eco*RI how many fragments will be produced from linear DNA and plasmid respectively.

6. An extra chromosomal segment of circular DNA of a bacterium is used to carry gene of interest into the host cell. What is the name given to it?

7. Identify the recognition sites in the given sequences at which *E.coli* will be cut and make sticky ends.

   5´–GAATTC–3´

   3´–CTTAAG–5´

SA-II (2 MARKS)

8. Name two main steps which are collectively referred to as down streaming process. Why is this process significant?

9. How does plasmid differ from chromosomal DNA?

10. A bacterial cell is shown in the figure given below. Label the part 'A' and 'B'. Also mention the use of part 'A' in rDNA technology.

11. Mention two classes of restriction enzymes. Suggest their respective roles.

12. In the given process of separation and isolation of DNA fragments, some of the steps are missing, Complete the missing steps –

    A : Digestion of DNA fragments using restriction endonucleases

    ↓

    B : .....

    ↓

    C : Staining with ethidium bromide

    ↓

    D : Visualisation in U.V. light

    ↓

    E : .....

    ↓

    F : Purification of DNA fragments.

SA-I (3 MARKS)

13. Since DNA is a hydrophillic moelcule, it cannot pass through cell membranes. Name and explain the technique with which the DNA is forced into (ii) a bacterial cell (ii) a plant cell (iii) an animal cell.
14. How will you otbain purified DNA from a cell?
15. In recombinant DNA technology, vectors are used to transfer a gene of interest in the host cells. Mention any three features of vectors that are most suitable for this purpose.
16. Why is *"Agrobacterium*–mediated genetic engineering transformation" in plants considered as natural genetic engineering?
17. Observe the given sequence of nitrogenous bases on a DNA fragment and answer the following question –

    5′ – CAGAATTCTTA – 3′

    3′ – GTCTTAAGAAT – 5′

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

    (b) Write the sequence after digestion.

    (c) Why are the ends generated after digestion called sticky ends?
18. A selectable marker is used in the section of recombinants on the basis of their ability to produce colour in presence of chromogenic substrate.

    (a) Mention the name of mechanism involved.

    (b) Which enzyme is involved in production of colour?

    (c) How is it advantageous over using antibiotic resistant gene as a selectable marker?

LA (5 MARKS)

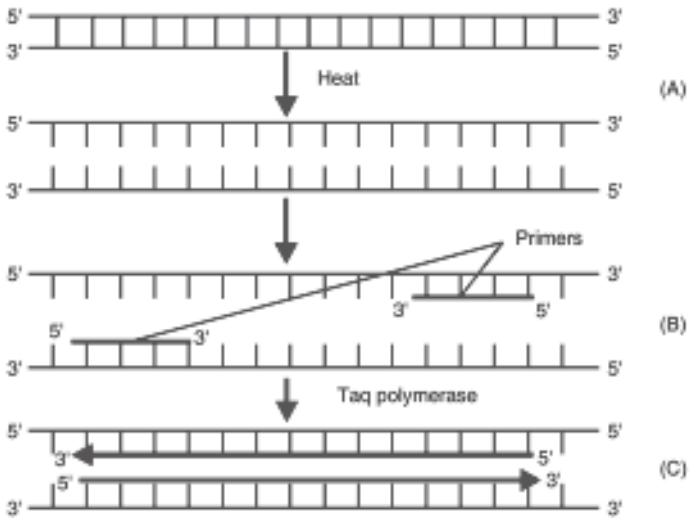
19. The development of bioreactors is required to produce large quantities of products.

    (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?

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

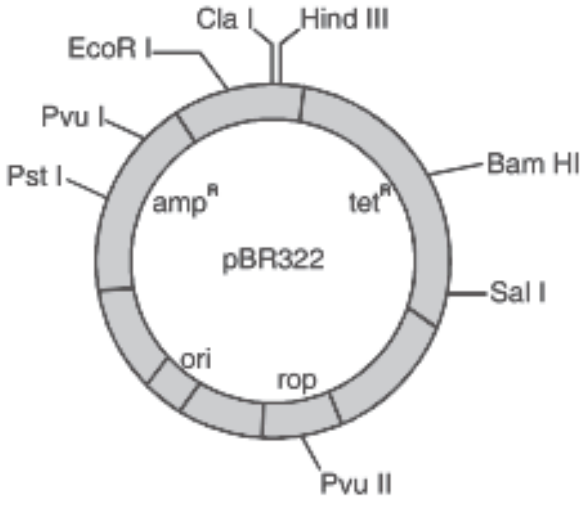


(a) Name the steps A, B and C.

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

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

21. Study the figure of vector pBR322 given below in which foreign DNA is ligated at the Bam H1 site of tetracyline 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.

ANSWERS

VSA (1 MARK)

1. Gel electrophoresis
2. Plasmid and Bacteriophage.
3. Restriction Enzymes.
4. E. – *Escherichia*; co – *coli*; R – Name of Strain; I – order in which enzyme isolated from strain of bacteria.
5. Number of fragments of linear DNA = 4

   Number of fragments of plasmid = 3
6. Plasmid.
7. 5′ – G↓AATTC 3′
   3′ – CTTAA↑G 5′

SA-II (2 MARKS)

8. ❑ Separation and Purification
   ❑ This process is essential because before reaching into market, the product has to be subjected for clinical trial and quality control.
9.

	Plasmid DNA		***Chromosomal DNA***
(i)	Circular DNA	(i)	Linear DNA
(ii)	Occurs only in bacterial cells	(ii)	Occurs in nucleus of eukaryotic cells and bacterial cell.
(iii)	Used as Vector in rDNA technology	(iii)	Not used as vector in rDNA technology.

10. A – Plasmid, B – Nucleoid

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

11. ❑ Exonucleases and endonucleases

❑ Exonucleases remove nucleotides from the ends of the DNA.

❑ Endonucleases cut DNA at specific sites beween the ends of DNA.

12. ❑ B – Gel Electrophoresis

❑ E – Elution

SA I (3 MARKS)

13. (i) Chemical treatment and exposure to cold and high temp. (42°C) alternatively. (Bacterial cell)

(ii) Biolistics or gene gun. (Plant cell)

(iii) Micro-injection. (animal cell)

Explanation – Refer page 200, biology Text Book for class XII.

14. ❑ Cells are treated with appropriate enzymes to release DNA. Lysozyme (bacteria), cellulase (plant cells), chitinase (fungus).

❑ RNA and proteins are removed by treatment with ribonuclease and protease enzymes respectively.

15. (ii) Have origin of replication(Ori)

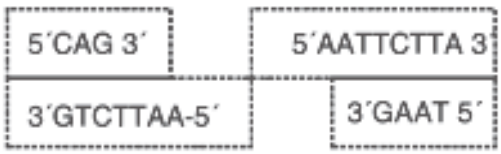
(ii) Have a selectable marker

(iii) Have at least one recognition site.

16. *Agrobacterium tumefaciens* is a pathogen in many dicot plants. It is able to deliver a piece of DNA (T–DNA) to transform normal plant cell into a tumor and directs these tumor cells to produce the chemicals required by pathogen.

17. (a) *Eco*RI

(b)



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

18. (a) Insertional inactivation

(b) β-galactosidase.

(c) Selection of recombinants due to inactivation of antibiotics requires simultaneous plating on two plates having different antibiotics. (Refer page 200 NCERT Biology for class XII)

LA (5 MARKS

19. (i) Temperature, pH, susbtrates, salts, vitamins and oxygen.

(ii) Figure 11.7(a) simple stirred–tank bioreactor Page No. 204 NCERT Text book, Biology - XII

(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.

20. (A) **Denaturation –** Heat denatures DNA to separate complementary strands.

(B) **Annealing :** Primers hybridises to the denatured DNA strands.

(C) **Extension :** Extension of primers resulting in synthesis of copies of target DNA sequence. Enzyme Tag polymerase is isolated from the bacterium *Thermus aquaticus*. This enzyme induces denaturation of double stranded DNA at high temperature.

21. (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.

CHAPTER 12

BIOTECHNOLOGY AND ITS APPLICATIONS

POINTS TO REMEMBER

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

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

***Cry* Protein :** The insecticidal protein which is produced by *Bacillus thuringiensis.*

Green Revolution : Substantial increase in crop yields due to use of high yielding varieties, use of fertilisers and pesticides, imrpoved agricultural practices etc.

Genetically Modified Organisms (GMO) : The organisms which have altered genes in them. These are also known as transgenic organisms.

Molecular Diagnosis : Refers to early detection of diseases using recombinant DNA molecules and techniques like PCR and autoradiography.

RNA Interference (RNAi) : Process used to develop pest resistant plants. It involves silencing of a specific mRNA due to complementary double stranded RNA.

Sustainable Agriculture : It involves organic farming and other integrated management practices which maintain soil fertility while increasing crop productivity.

Uses of GM Plants : Tolerant to abiotic stress, Reduced dependence on chemical pesticides, less post harvest-loss, Efficient use of minerals, enhanced nutritional value.

Uses of Transgenic Animals : To study normal physiology and development, to study diseases, to get biological products, to test vaccine and chemical safety testing.

Gene Therapy : It is a technique of inserting genes into the cells and tissue of an individual to treat a hereditary disease.

- The first clinical gene therapy was given in 1990 to a four year old girl with adenosine deaminase (ADA) deficiency. ADA enzyme is required for proper functionng at immune system.
- This disorder is caused due to the deletion of the gene for adenosine deaminase enzyme.
- In some children ADA deficiency can be cured by bone marrow plantation. Lymphocytes from the blood of patient are grown in a culture. A functional ADA cDNA is then introduced into these lymphocytes using retroviral vector. The lymphocytes are transferred into the body of patients.
- As these cells are not immortal, the patient required periodic infusion of such genetically engineered lymphocytes.
- If a functional gene is introduced into a bone marrow cells at early embryonic stage, It could be a permanent cure of ADA deficiency.

Bt. Cotton : The soil bacterium *Bacillus thuringiensis* produced crystal protein called *cry* protein that kills certain insects larvae such as tobacco budworm, armyworm, beettles and flies.

- Bt toxin protein exists as inactive protoxins, but once an insect ingest this inactive toxin, it is converted into active form of toxin due to the alkaline pH of the gut which solubilise the crystal. This causes swelling and lysis of epithelial cells of midgut leading to death of insect larvae.
- Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into the several crop plants such as cotton.
- The proteins encoded by the genes :

  crylAc and cryllAb control the cotton bollworms and *crylAb* control corn borer.

  Pest Resistant Plants : A nematode *Meloidegyne incognitia* infects tobacco plants and reduces their yield.
- Nematode specific genes were introduced into the host plant using *Agrobacterium* as a vector.
- The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells.
- These two RNAs being complementary to each other formed a double stranded RNA (dsRNA) making it inactive.
- This dsRNA molecule binds to and prevents translation of mRNA (silencing) of the nucleotide by the process called RNA interference (RNAi).

- ❑ The result was that the parasite could not survive in the transgenic host and the transgenic plant got protected for the parasite.

Three Critical Research Areas of Biotechnology

(i) Providing best catalyst in the form of improved organism usually a microbe.

(ii) Creating optimal conditions for a catalyst to act.

(iii) Downstreaming processing technologies to purify the desirable product.

QUESTIONS

VSA (1 MARK)

1. Name the technique based on the principle of antigen-antibody interaction used in detection of a virus (HIV).
2. Development of a transgenic food crop may help in solving the problem of night blindness in the developing countries, name this crop plant.
3. Which nematode infects the roots of tobacco plant and causes a great reduction in yield?
4. The first transgenic cow, produced human protein – enriched milk. Name the cow and the protein found in milk.
5. The insulin produced using recombinant DNA technology is more advantageous than the insulin extracted from pancreas of slaughtered cattle and pigs. How?
6. Name two pest resistant plants produced by using recombinant DNA technology.

SA-II (2 MARKS)

7. What are the two methods for correcting ADA deficiency in a child?
8. Some crop plants are modified genetically by manipulating their genes. How are they made beneficial?
9. GEAC is one of the organisation set up by Indian Government. Write its full form. Give its two objectives.
10. "Industrialised nations are exploiting the bioresources of under industrialised nations". Justify the statement with a suitable example.

SA-I (3 MARKS)

11. Some multinational companies and other organisations are using bioresources for commercial benefits, without proper authentication and compensation to concerned authorities.

    (a) Give the term for this unauthorised act.

    (b) Suggest any two ways to get rid of this.

12. A bacterium *Bacillus thuringiensis* produces a toxic protein named '*cry* protein' that is lethal to certain insects but not to bacterium

    (a) Why this toxin does not kill the bacteria?

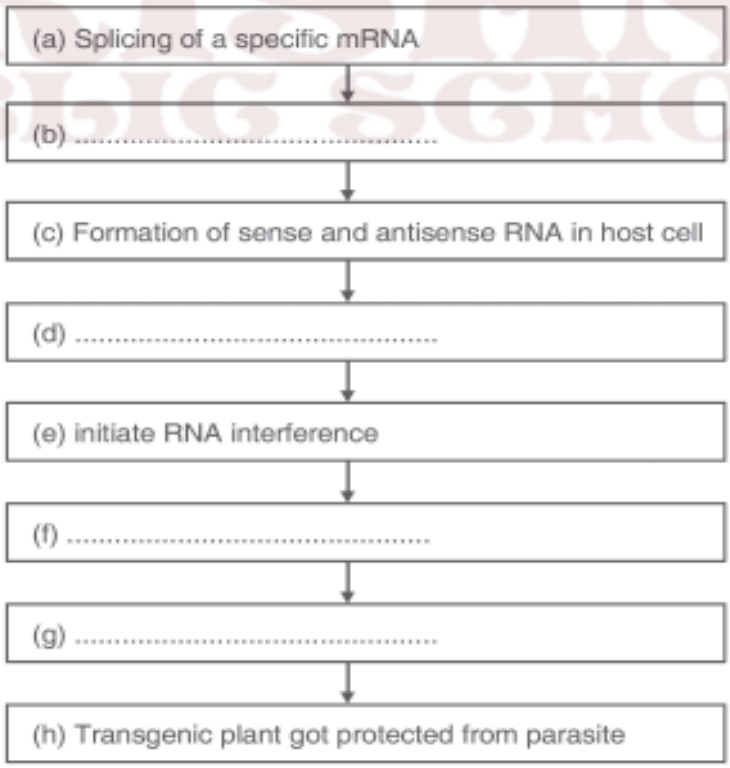
    (b) What type of changes occur in the gut of insects on consuming this protein?

    (c) How man has exploited this protein for his benefit?

13. Given below is an incomplete flow chart showing the process of production of nematode resistant tobacco plants based on RNAi technique.

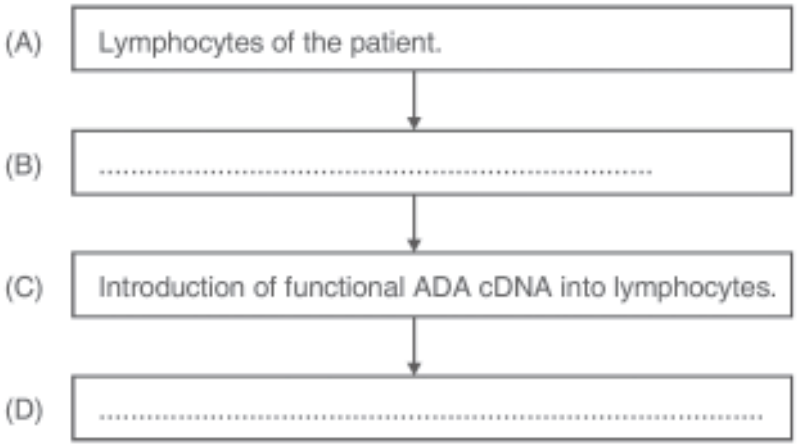
    (i) Write the missing steps in proper sequence

    (ii) At which level RNAi silences the gene?



LA (5 MARKS)

14. The clinical gene therapy is given to a 4 years old patient for an enzyme which is crucial for the immune system to function.



Observe the therapeutical flow chart and give the answer of the following:

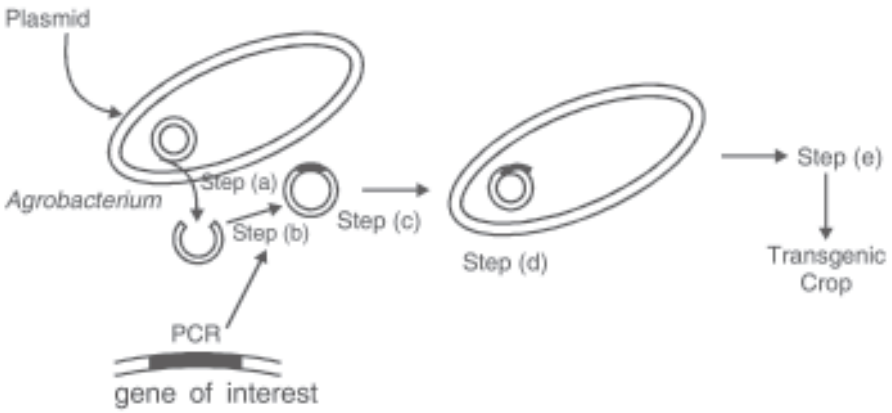
(a) Complete the missing steps (B) and (D)

(b) Identify the disease to be cured.

(c) Why the above method is not a complete solution to the problem?

(d) Scientists have developed a method to cure this disease permanently. How?

15. In the given figure, *Agrobacterium* is utilized for the production of a transgenic crop. Explain the steps a, b, c, d and e shown in the figure.



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

Form 'A' Form 'B'

(a) What type of bonding is present between chains of this hormone?

(b) What are these form (A) and form (B). How these forms differ from each other?

(c) Explain how was this hormone produced by Eli Lilly, an American company, using rDNA technology.

ANSWERS

VAS (1 MARK)

1. ELISA (Enzyme linked immuno - sorbent Assay)
2. Golden Rice
3. *Meloidegyne incognitia.*
4. Rosie, alpha-lactalbumin
5. Insulin obtained from animal source causes allergy.
6. Bt Cotton, Bt Corn, Bt Brinjal.

SA-II (2 MARKS)

7. Bone marrow transplantation having functional ADA enzyme and Enzyme replacement therapy.
8. More tolerant to abiotic stresses; pest resistant; reduction in post harvest losses; increased nutritional value of food.
9. GEAC – Genetic Engineering approval committee. Objectives of GEAC are
   (i) To make decisions regarding validity of GM research.
   (ii) Safety of introducing GMO for public use.

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

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

SA-I (3 MARKS)

11. (a) Biopiracy

(b) (i) Benefits of bioresources should be shared between developed and developing nations

(ii) Laws should be developed to prevent unauthorsied exploitation of them bioresources.

12. (a) Produced in inactive form as Prototoxins.

(b) Prototoxin becomes active toxin in alkaline pH of gut of insects. Toxins bind to surface of midgut and cause perforation, swelling, lysis of cells ultimately leading to death.

(c) Specific Bt toxin genes isolated from *Bacillus thuringiensis* and incorporated into several crop plants such as cotton and corn which become pest resistant against certain insects.

13. (i) (b) Using *Agrobacterium* as a vector, introduced into tobacco

(d) dsRNA (double stranded RNA)

(f) Silenced specific mRNA of the nematode

(g) Parasite could not survive.

(ii) RNAi silences the gene at translation level

LA (5 MARKS)

14. (a) Step (B) : Lymphocytes are grown in culture medium.

Step (D) : Infusion of genetically engineered lymphocytes into patients.

(b) Adenosine deaminase (ADA) deficiency.

(c) As genetically engineered lymphocytes are not immortal, the patient requires periodic infusion of cells.

(d) If the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

15. **Step (a)** Plasmid is removed and cut open with restriction endonuclease.

Step (b) Gene of interest is isolated from another organism and amplified using PCR

Step (c) New gene is inserted into plasmid

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

Step (e) *Agrobacterium* based transformation.

16. (a) Disulphide bonds

(b) Form (A) – Proinsulin

Form (B) – Mature insulin.

Proinsulin contains an extra stretch called C – peptide which is absent in mature insulin.

(c) Eli Lilly company prepared two DNA sequences corresponding to A and B peptide chains of human insulin and introduced them in plasmid *E. coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulphide bonds to form insulin.

CHAPTER 13

ORGANISMS AND POPULATIONS

POINTS TO REMEMBER

Adaptation : Any attributes of the organism (morphological, physiological, behavioural) that enables the organism to survive and reproduce in its habitat.

Aestivation : Strategy to escape in time during summers (summer sleep). E.g., Snails and some fishes.

Allen's Rule : Mammals from colder climates generally have shorter ears and limbs to minimise heat loss.

Carrying Capacity : Maximum number of individuals of a population which can be provided with all the necessary resources for their healthy living.

Commensalism : One organism is benefitted while the other is neither harmed nor benefitted except to a negligible extent.

Competition : Rivalry between two organisms for obtaining the same resources.

Ectoparasite : Parasites which live on the surface of their host.

Emigration : Number of individuals of the population who have left the habitat and gone elsewhere during a given time period.

Exponential Growth Curve : Shows that if food and space for a population are unlimited and each species has the ability to grow, then the population grows in exponential or geometric ratio.

Hibernation : Strategy to escape in time during winters (winter sleep). E.g., Polar bears.

Homeostasis : Maintaining constancy of internal environment despite varying external environmental conditions.

Immigration : Number of individuals of the same species that have come into the habitat from elsewhere during a given time period.

Ecology : A branch of science that studies the reciprocal relationships between organism and their physical environment. Ecology is basically concerned with four levels of biological organisation– organisms, populations, communities and biomes.

Organisms : Organisms form the basic unit of study in ecology. Organisms with similar features and the potential interbreed among themselves and produce fertile offspring, constitute a species.

Populations : Population is a group of individuals of the same species, inhabiting in a given area. Interspecific competition for basic needs operate among the individuals of a population.

Biological Community : Biological community is constituted by an assemblage of the populations of all different species that live in an area and interact with each other. A biotic community has a distinct species composition and structure.

Biomes : Biome is a very large unit, constituting of a major vegetation type and associate fauna found in a specified zone. Annual variations in the intensity, duration of temperature and precipitation account for the formation of major biomes like desert, rain forest and tundra.

Major Biomass of India : Tropical rain forest, deciduous forest, desert, sea coast. Regional and local variations within each biome lead to the formation of a wide variety of habitats.

Environment : Environment is a sum total of all biotic and abiotic factors that surround and potentially influence an organism. Temperature, water, light and soil are the major abiotic factors.

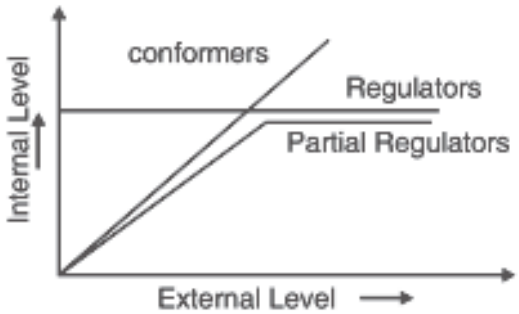
Response to Abiotic Factors :

(i) **Regulators :** Some organisms are able to maintain homeostasis by physiological (Some times behavioural) means which ensures body temperature, constant osmotic concentration. All birds and mammals, a very few lower vertebrates and invertebrates are regulators (Thermoregulation and osmoregulation). For example, human beings maintain their body temperature by sweating in summer and shivering during winter season. Plants do not have such mechanisms to maintain internal temperatures.

(ii) **Conformers :** Majority of animals and nearly all plants cannot maintain a constant internal environment. Their body temperature changes with the ambient temperature. In aquatic animals the osmotic concentration of the body fluids change with that of the ambient water and osmotic concentration. Some species have evolved the ability to regulate, but only

over a limited range of environmental conditions, beyond which they simply conform.

A diagrammatic representation of organismic response is shown below.

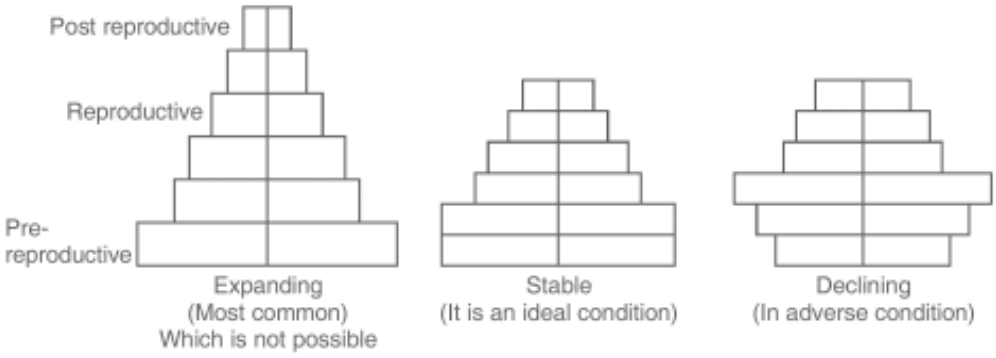


(iii) **Partial regulators :** Hair on the body – Hair on body acts as heat insulator. Surface area and volume ratio – In smaller organisms the surface area is large as compared to the volume. But in large animal this ratio is small. So, the larger animals effectively controls the body temp erature.

(iv) **Migration :** The organisms can move away temporarily from the stressful habitat to a more hospitable area and return when stressful period is over.

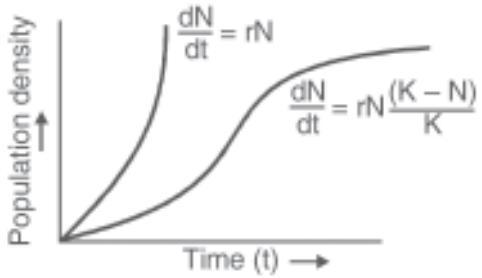
(v) **Suspend :** The organisms may avoid the stress by escaping in time. Bears go into hibernation winter, some snails and fish go into aestivation in summer.

Age Pyraminds of Populations : A population at any given time is composed of individuals of different ages. If the age distribution is plotted for the population, the resulting structure is called an age pyramid. The shape of the pyramids reflects the growth status of the populations (a) Whether it is growing (expanding) (b) Stable or (c) Declining. A pyramids for human population (males and females) are represented below.



Population Growth : If 'N' is the population density at time 't', then its density at time t + 1 is :

$$N_{t+1} = Nt + [(B + I) - (D + E)]$$



Where B = The number of births

I = The number of immigrants

D = The number of deaths

E = The number of Emigrants.

N = Population Density

r = Intrinsic rate of natural increase

t = Time period

K = Carrying capacity (The maximum population size that an environment can sustain)

Population Interactions :

Predation : Interaction between species involving killing and consumption of prey is called predation. The species which eats the other is called the predator and the one consumed is termed the prey. The predator keeps check on prey population. The reduction in predator population may lead to increase in prey population.

Competition – In this fitness of one species is significantly lower in presence of another species

Competitive release – A species whose distribution is restricted to a small geographical area because of a competitively superior species, is found to expand its distributional range when the competing species is experimentally removed

Competitive Exclusion Principle – Two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated.

Resource partitioning – If two species compete for the same reasource, they could avoid competition by choosing different times for feeding.

Commensalism : This is the interactio in which one species benefits and the other is neither harmed nor benefited under normal conditions.

Parasitism : Parasitism is a kind of relationship between two species in which one derives its food from the other (host). Parasitism also involves shelter, in addition to food obtained by a parasite. Parasites may be ectoparasites or endoparasites.

Mutualism : In mutualism both the interacting species are benefited mutually. It is also known as symbiosis.

Co-evolution – 1) Fig species and wasp. Female wasp uses the fruit as an qviposition (egg-laying) and also uses the developing seeds within the fruits for nourishing its larvae. Wasp pollinates the fig inflorescence while searching for egg laying site, in return big offers developing seeds as food for developing larvae. 2) Mediternanean orchid Ophrys and bee.

Amensalism : Interaction between two different species, in which one species is harmed and the other is neither benefited nor harmed.

Examples of Parasitism :

(i) Cuscuta growing in shoe flower plant

(ii) Head louse and humans

(iii) *Ascaris, Taenia, Plasmodium* causing diseases in humans

Examples of Brood parasitism :

(i) Koel laying its eggs in crow's nest.

Examples of Commensalism :

(i) Clown fish living among tentacles of sea anemone

(ii) Pilot fish *(Remora)* accompanies sharks

(iii) Orchid growing on mango tree

(iv) Sea anemone on the shell of hermit crab

(v) Barnacles on back of whales

(vi) Egret and grazing cattle

Examples of Mutualism

(i) Mycorrhiza living in roots of higher plants

(ii) Rhizobium in root nodules of legumes

(iii) Algae and fungi in lichens

(iv) Orchid *Ophyrs* and bee for pollination (employs sexual deceit)

Example of Amensalism

(i) Penicillium whose toxin kills many bacteria is neither benefitted nor harmed

Examples of Predation

(i) Biological control methods to control pests

(ii) Carnivorous animals like tiger eating deers, snake eating frog

(iii) Insectivorous plants like Nepenthes, Drosera, Utricularia

Growth Models : The two growth models are :

(i) Exponential growth model

Exponential Growth Equation is $N_t = N_0e^{rt}$

Where

Nt = Population density after time t

N0 = Population density at time zero

r = intrinsic rate of natural increase

e = the base of natural logarithms (2.71828)

(ii) **Logistic growth model**

Verhulst-Pearl Logistic Growth is described by the following equations :

$dN/dt = rN (K–N / N)$

Where N = Population density at time t

r = Intrinsic rate of natural increase

K = Carrying capacity

(i) **Exponential growth** ('J' shape curve is obtained).

* When responses are not limiting the growth.
* Any species growth exponentially under unlimited resources conditions can reach enormous population densities in a short time.
* Growth is not so realistic.

(ii) Logistic Growth (Sigmoid curve is obtained)

* When responses are limiting the Growth.
* Resources for growth for most animal populations are finite and become limiting.
* The logistic growth model is a more realistic one.

QUESTIONS

VSA (1 MARK)

1. Which are the factor responsible for the wide variety of habitat formed within each biome?
2. Fresh water animals are unable to survive for long in sea water. Give reason.
3. With which population growth model is the Verhulst Pearl equation associated?
4. Define diapause. Which organisms exhibit it?
5. Calculate the death rate if 6 individuals in a laboratory population of 60 fruit flies died during a particular week.
6. In biological control method, one living organism is used against another to check its uncontrolled growth. Which kind of population interaction is involved in this?
7. An organism has to overcome stressful condition for a limited period of time. Which strategies can it adopt to do so?
8. Write what do phytophagous insects feed on?

SA-II (2 MARKS)

9. What are the four levels of biological organisation with which ecology basically deals?
10. Differentiate between stenohaline and euryhaline organisms.
11. List four features which enable the Xeric plants to survive in the desert conditions.
12. Mention the attributes which a population has but not an individual organism.
13. Differentiate between stenothermal and eurythermal organisms.
14. What are the four ways through which the living organisms respond to abiotic factors?
15. Why do clown fish and sea anemone pair up? What is this relationship called?

SA-I (3 MARKS)

16. How does the shape of age pyramid reflect the growth status of a population?
17. Darwin showed that even a slow growing animal like elephant could reach enormous number in absence of checks. With the help of your understanding of growth models, explain when is this possible? Why is this notion unrealistic?
18. How will you measure population density in following cases?
    (i) fish in a lake
    (ii) tiger census in a national park
    (iii) single huge banyan tree with large canopy.
19. Species facing competition might evolve mechanism that promotes co-existence rather than exclusion. Justify this statement in light of Gause's competitive exclusion principle, citing suitable examples.

LA (5 MARKS)

20. What is altitude sickness? What its causes and symptoms? How does human body try to overcome altitude sickness?
21. Orchid flower, Ophrys co-evolves to maintain resembelance of its petal to female bee. Explain how and why does it do so?

ANSWERS

VSA (1 MARK)

1. Regional and local variations
2. Due to osmotic problems.
3. Logistic Growth.
4. A stage of suspended development, zooplanktons.
5. 6/60 =0.1 individuals per fruitfly per week.
6. Predation.
7. (i) Migration
   (ii) Suspension of active life by hibernation/aestivation/spore formation.
8. Plant sap and other parts of plant.

SA-II (2 MARK)

9. Organisms, population, communities and biomes.
10. **Euryhaline :** Organisms tolerant in wide range of salinities.

    Stenohaline : Organisms tolerant to narrow range of salinities.
11. (i) thick cuticle

    (ii) Stomata in deep pits

    (iii) Stomata closed during day time

    (iv) leaves reduced to spines (CAM photosynthetic pathway).
12. Birth rate, Death rate, Sex ratio, age groups.
13. **Eurythermal :** Organisms that can tolerate and thrive in wide range of temperatures

    Stenothermal : Organisms restricted to a narrow range of temperature.
14. (i) Regulate (ii) Conform (iii) migrate (iv) Suspend
15. Clown fish lives in tentacles of sea Anemone and gets protection from predators.

    Interaction – commeasalisn.

SA-I (3 MARKS)

16. Shape of pyramids reflects growth statusof the population (a) growing (b) Stable (c) declining.

    Refer page 227, Fig. 13.4, NCERT book, Biology - XII
17. Possible if the growth model is Exponential, i.e., having unlimited resources. Its an unrealistic situation because resources are limited. Hence, it follows logistic growth model.
18. (a) fish caught per trap.

    (b) number per unit area

    (c) percentage cover in biomass.
19. State Gause's competitive exclusion principle. Mechanisms is resource partitioning. E.g., experiment of Mac Arthur on Warblers (Refer page 325, NCERT book, Biology - XII).

LA (5 MARKS)

20. Breathlessness at high attitudes.

Cause : Low atmospheric pressure at high altitudes due to which body does not get enough oxygen.

Symptoms : Nausea, fatigue and heart palpitations.

Body adapts by :

(a) increasing red blood cell production

(b) decreasing binding affinity of haemoglobin

(c) by increasing breathing rate.

21. ❑ employs 'Sexual deceit'

❑ one petal bears uncanny resemblance to female of the bee.

❑ Male bee is attracted to what it perceives as a female 'pseudocopulates,' during which pollen dusted on male bee¡¦s body.

❑ Male bee transfers pollen to another flower when the same bee pseudocopulates with another flower.

❑ *Ophrys* does so because pollination success will be reduced unless it co-evolves with female bee.

CHAPTER 14

ECOSYSTEM

POINTS TO REMEMBER

Startification : Vertical distribution of different species occupying different levels in an ecosystem.

Primary Production : Amount of biomas or organic matter produced per unit area over a time period by plants during photosynthesis.

Productivity : Rate of biomass production. Its unit is g/m2/year.

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

Net Primary Productivity : Gross primary productivity minus the respiration losses.

Ecosystem : Relationship between living organisms and their abiotic surroundings.

Secondary Productivity : Rate of formation of new organic matter by consumers.

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

Detrivore : Organisms who break down detritus into smaller particles. e.g., earthworm.

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

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

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

Pioneer species : The species that invade a bare area at the onset of ecological succession.

Process of Decomposition : The decomposers break down complex organic matter into inorganic substances like carbon dioxide, water and nutrients. This process is called decomposition. Steps of decomposition are :

(i) **Fragmentation :** Break down of detritus into smaller particles by detritivores (earthworm).

(ii) **Leaching :** Water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.

(iii) **Catabolism :** Bacterial and fungal enzymes degrade detritus into simple inorganic substances.

(iv) **Humification :** Accumulation of a dark coloured amorphous substances called humus.

(v) **Mineralisation :** The humus is further degraded by some microbes and release of inorganic nutrients occur.

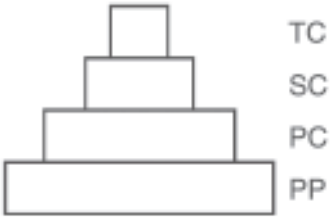
Energy Flow : Energy flow is the key function in the ecosystem. The plants (producers) capture only 2 – 10 percent of the photosynthetically active radiation (PAR). Unidirection flow of energy is taken place from the sun to producers and them to consumers. About 10% energy flows from one trophic level to another.

Grazing Food Chain : It begins with producers.

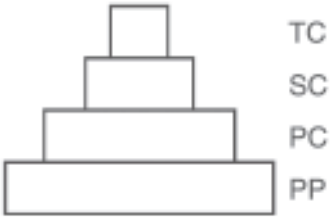
Detritus Food Chain : It begins with dead organic matter. It is made up of decomposers (Fungi, Bacteria). They meet their energy and nutrient requirements by degrading detretus. These are also known as saprotrophs.

Ecological Pyramids

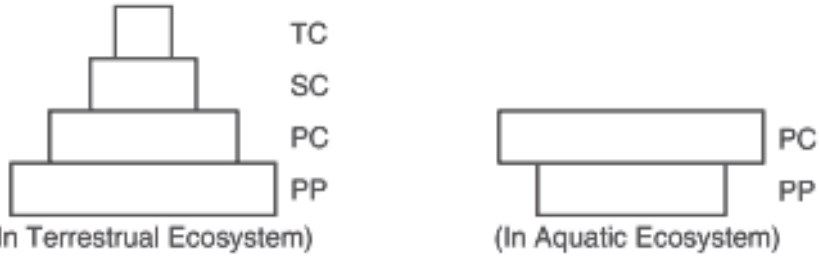
(i) Pyramid of Numbers : (Grass land system)



(ii) Pyramid of Energy : (Always upright in all Ecosystems)



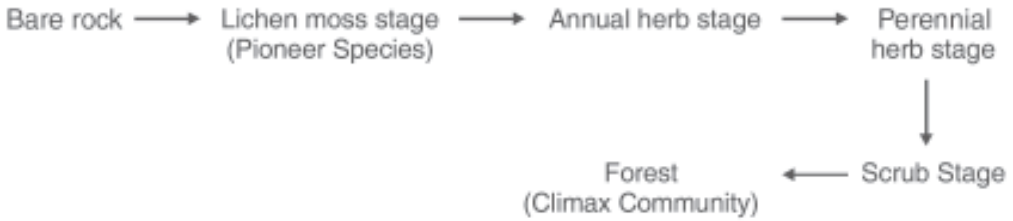
(iii) Pyramid of Biomass :



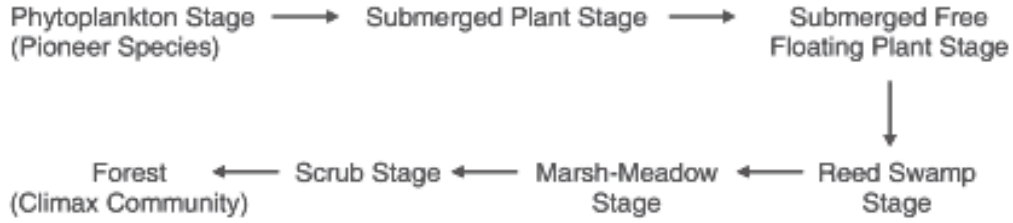
Ecological Succession : The gradual and fairly predictable change in the species composition of a given area is called ecological succession. The species that invade a bare area is called pioneer species. The final community is an ecological succeesion that is in near equilibrium with the environment is called climax community

Secondary Succession begins in the area where natural biotic communities have been destroyed (burned or cut forests, land that have been devastated by flood).

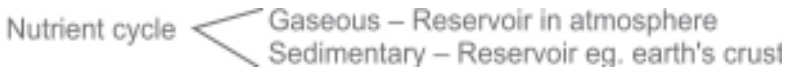
Succession on a Bare Rock (Xerarch)



Succession in Aquatic environment (Hydrarch)

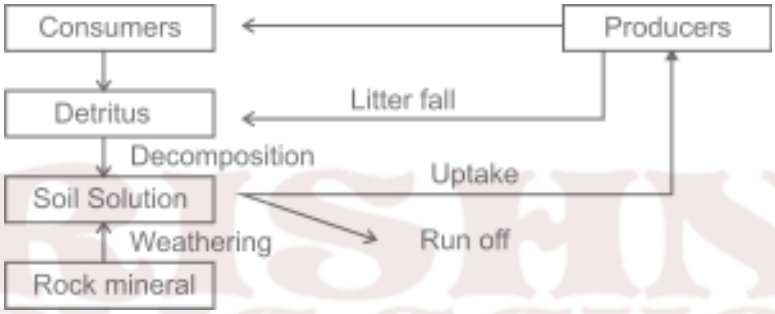


Nutrient Cycling – Movement of nutrient elements through the various components of an ecosystem also called Biogeochemical cycles.



Carbon cycle – occurs through atmosphere, ocean, and though living and dead organisms. Considerable amount of carbon returns to atmosphere as CO_2 through respiratory activities, decomposers also contribute to Carbon di-oxide pool, burning of wood, forest fire and combustion of organic matter, fossil fuels, volcanic activity also release CO_2 is atmosphere.

Phosphorous cycle – Sedimentary cycle Rocks contain phosphorous in the form of phosphates



Carbon Cycle	***Phosphorous Cycle***
1. Amount of atmospheric inputs more in amount	1. Amount of atmospheric inputs less in amounts
2. Degree of exchanges between organism and environment high	2. Degree of exchange between organism and environment negligible.

ABBREVIATIONS

PAR : Photosynthetically Active Radiation

GAP : Gross Primary Productivity

NPP : Net Primary Productivity

DFC : Detritus Food Chain

GFC : Grazing Food chain

QUESTIONS

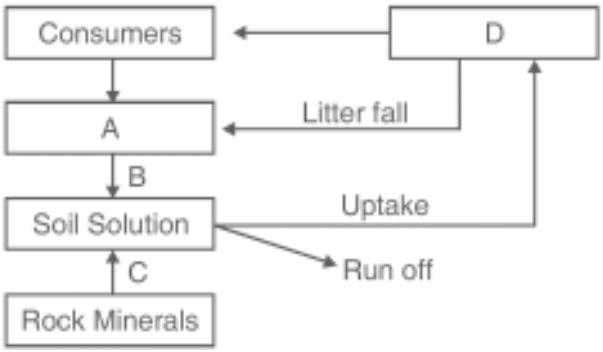
VSA (1 MARK)

1. Decomposition is faster if deteritus is rich in nitrogen and water soluble substance like sugars. When is the decomposition process slower?
2. If we count the number of insects on a tree and number of small birds depending on those insects as also the number of larger birds eating the smaller, what kind of pyramid of number would we get?
3. Differentiate between Sere and Seral communities.
4. Who are generally the pioneer species in a Xerarch succession and in a Hyararch succession?
5. Which metabolic process causes a reduction in the Gross Primary Productivity?
6. What percentage of photosynthetically active radiation is captured by plants?
7. Name the pioners of primary succession in water.

SA-II (2 MARKS)

8. What is the shape of pyramid of biomass in sea? Why?
9. Give an example of an ecological pyramid which is always upright. Justify your answer.
10. Differentiate between primary succession and secondary succession. Which one occurs faster?
11. Gaseous nutrient cycle and sedimentary nutrient cycles have their reservoir. Name them. Why is a reservoir necessary?
12. Fill up the missing links depicted as A, B, C and D in the given model of primary succession.

13. In the model of phosphorus cycle given below, what does A, B, C and D refer to?



14. Differentiate between Hydrarch and a Xerarch succession.

15. What is the effect on decomposition rate if :–
    a) Detritus is rich in lignin and chitin
    b) Detritus is rich is nitrogen and sugars

16. What are the limitations of ecological pyramids?

17. Name any four ecosystem services. Who gave the price tags on nature's life support services? Which is the most important ecosystem service provider?

18. Study the table given below and fill the blanks from 'A' to 'F'.

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

19. In the pyramid of biomass drawn below, name the two crops (i) one which is supported (ii) one which supports in which ecosystem is such a phyramid found?

LA (5 MARKS)

20. Detrivores like earthworm are involved in the process of decomposition of dead plants and animals. Describe the different steps involved in the process of decomposition.

ANSWERS

VSA (1 MARK)

1. Its slower if detritus is rich in lignin and chitin.
2. Inverted Pyramid of Number.
3. **Sere :** Entire sequence of communities that successively change in a given area.

   Seral community : Individual transitional community.
4. Pioneer species in Hydrarch succession are usually the small phytoplanktons and that in Xerarch succession are usually lichens.
5. Respiration.
6. 2 – 10%
7. Phytoplanktons

SA-II (2 MARKS)

8. Inverted, because biomass of fishes far exceeds that of phytoplankton.
9. Pyramid of energy is always upright and can never be inverted, because when energy flows from a trophic level to the next trophic level some energy is always lost as heat at each step.
10. **Primary Succession :** A process that starts where no living organisms are there.

    Secondary succession : A process that starts in areas which have lost all the living organisms that existed there.
11. Reservoir for Gaseous nutrient cycle : Atmosphere; for sedimentary nutrient cycle : Earth's crust. Reservoir is needed to meet with the deficit which occurs due to imbalance in the rate of influx and efflux.

12. A = Submerged plant stage B = Reed Swamp Stage
    C = Scrub stage D = Forest stage
13. A = Detritus B = Decomposition
    C = Weathering D = Producers.
14. **Hydrarch Succession :** Starts in water proceeds from hydric (aquatic) to mesic (neither dry nor wet) situations.

    Xerarch succession : Starts on barren rock Proceeds from Xeric (dry) conditons.
15. a) Decomposition rate is slower
    b) Decomposition rate is faster.
16. (i) Does not take into account same species belonging to two or more trophic levels.
    (ii) Assumes simple food chain, does not accomodate food web.
    (iii) Saprophytes have not been given any place in ecological pyramids.
17. ❑ Forest (ecosystem) purify water and air
    ❑ Mitigate Droughts and floods
    ❑ Nutrient cycling
    ❑ Generate fertile soil
    ❑ Provide habitat for wildlife
    ❑ Pollinate flower
    ❑ Maintain Biodiversity
    ❑ Provide aesthetic, cultural & spiritual values
    ❑ Robert Constanza gave price tags to ecosystem services.
    ❑ Most important ecosystem services provider : Soil formation.
18. A = First trophic level
    B = Primary consumer
    C = Zooplankton, Cow, Grass hopper
    D = Third trophic level
    E = Tertiary consumer
    F = Man, Lion

19. (i) Supported trophic level is founded by zooplanktons

(ii) Supporting trophic level is formed by phytoplanktons ecosystem

It is found in aquatic ecosystem.

20. The dead remains of plants and aminals called detritus undergo decomposition and are converted into simpler substances. The steps of this process are :

(i) **Fragmentation :** Breakdown of detritus into smaller pieces by detrivoures like earthworm.

(ii) **Leaching :** Water soluble inorganic nutrients go down into soil horizon and get precipitated as unavailable salts.

(iii) **Catabolism :** Bacterial and fungal enzymes degrade detritus into simpler inorganic substances.

(iv) **Humification :** It leads to accumulation of dark coloured amorphous substance called humus which is highly resistant to microbial action so decomposes at slow rate and is rich in nutrients.

(v) **Mineralisation :** Humus is further degraded by some microbes and release of inorganic nutrients occurs.

CHAPTER 15

BIODIVERSITY AND CONSERVATION

POINTS TO REMEMBER

Biodiversity : Term used to describe diversity at all levels of biological organisation. Term coined by socio-biologist Edward Wilson and was also used by Walter G Rosen for the diversity of life forms. Biodiversity refers to totality of genes in species and ecosytems of a region.

Three inter-related levels of Biodiversity : Genetic diversity, Species diversity, Ecological diversity.

- ***Genetic diversity :*** Diversity in the number and types of genes, as well as chromosomes present in different species and the variations in the genes and their alleles in the same species. It helps in speciation.
- ***Species diversity :*** Varieties in the number and richness of the species of a region.
- ***Ecological diversity :*** Variety in the types of ecosystems.

IUCN : International Union for Conservation of Nature and Natural Resources. It is situated in Morges, Switzerland.

India has : More than 50,000 genetically different varieties of rice; 1000 varieties of mango;

- India has 1,42,000 known species of plants and animals (Around 45,000 species of plants and rest of animals);
- India has 8.1% of share of global biodiversity.
- India is one of **12 Mega diversity** countries of the world.

Latitudinal Gradients

- In general, species diversity decreases as we move away from the equator towards the poles.
- With very few exceptions, tropics (latitudinal range of 23.5¢X N to 23.5¢XS) harbour more species than temperate or polar areas.

- Colombia located near the equator has nearly 1,4000 species of birds while New York at 41°X N has 105 species and Greenland at 71°X N only 56 species.
- India has more than 1,200 species of birds.
- A forest in a tropical region like Equador has up to 10 times as many species of vascular plants as a forest of equal area in a temperate region like the Midwest of the USA.
- The largely tropical Amazonian rain forest in South America has the greatest biodiversity on earth.

Species-Area relationships

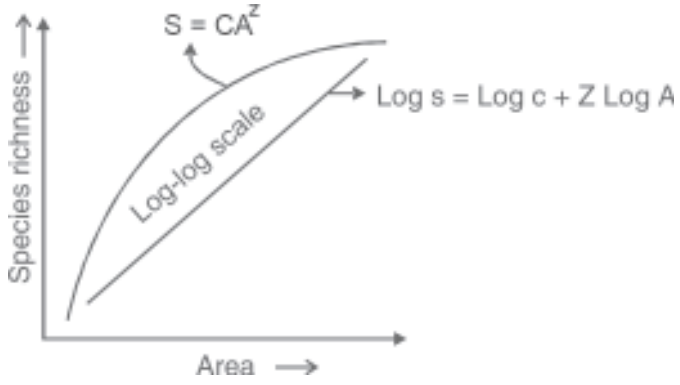
- German naturalist and geographer Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit.
- The relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, freshwater fishes) turns out to be a rectangular hyperbola.
- On a logarithmic scale, the relationship is a straight line decribed by the equation

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

Where S = Species richness, A = Area; Z = slope of the line (regression coefficient)

C = Y – intercept.

- Value of Z lies in the range of 0.1 to 0.2, regardless of the taxonomic group or the region.
- The species-area relationships among very large areas like the entire continents has much steeper slope of the line (Z values in the range of 0.6 to 1.2).



Causes of Biodiversity Losses

1. **Habitat loss and fragmentation :** This is most important cause of plants and animals extinction. *For example :* Tropical rain forest being destroyed fast. The Amazonian rain forest is called the 'lungs of the planet'. It is being cut for cultivating soyabeans.
2. **Over–exploitation :** Many species extinctions are due to over exploitation by humans. eg :- extinction of steller's cow, passenger pigeon is last 500 years.
3. **Alien Species Invasions :** When alien species are introduced some of them turn invasive and cause decline or extinction of indigenous species. eg. :- Carrot grass (Parthenium), Lantana and water hyacinth *(Eichornia)* posed threat to native species.
4. **Co-extinctions :** When a species becomes extinct, the plant and animal species associated with it in an obligating way also become extinct. eg.:- When a host fish species becomes extinct, its assemblage of parasites also becomes extinct.

Reasons for Conservation of Biodiversity

1. **Narrowly utilitarian :** Humans derive countless direct economic benefit from nature food (cereals, pulses, fruits), firewood, fibre, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes) and products of medicinal importance.
2. **Broadly utilitarian :** Biodiversity plays a major role in many ecosystem services that nature provides.
3. **Ethical :** every species has an intrinsic value, even if it may not be of any current economic value to us. We have a moral duty to care for their well-being and pass on our biological legacy in good order to future generations.

Types of Conservation Strategies

In-situ conservation : Conservation and protection of the whole ecosystem and its biodiversity at all levels in order to protect the threatened species. Endangered species protected in natural conditions.

- **Sacred Groves :** Tracts of forest are set aside and all the trees and wildlife within are venerated and given total protection. E.g., some forest in Khasi and Jaintia hills in Meghalaya, Aravalli hills of Rajasthan.

- **Hot Spots :** Areas with high density of biodiversity or mega diversity. E.g., Out of 34 hot spots in world, 3 occur in India. i.e., Western Ghats and Sri Lanka, Indo-Burma (North-East India) and Himalaya.
- **Protected Areas :** Ecological or Biogeographical areas where biological diversity with natural and cultural resources are protected. E.g., National parks, sanctuaries and Biosphere reserves.

Ex-situ conservation : Conservation and protection of selected rare plants or animals in places outside their natural homes.

- **Offsite collections :** Live collections of wild and domesticated species in Botanical gardens, Zoological parks etc.
- **Gene Banks :** Institutes which maintain stock of viable seeds, live growing plants, tissue culture and frozen germplasm with the whole range of genetic variability.

Cryopreservation : Preservation of seeds, embryos etc. at ¡V196¢XC in liquid nitrogen.

Co-extinction : Extinction of a species can cause extinction of plants and species associated with it.

National Parks : Areas reserved for wild life where they are able to obtain all the required natural resources and proper habitats. India has 89 national parks at present.

Sanctuaries : Tracts of land with or without lake where animals are protected from all types of exploitation and habitat disturbance. India has 492 sanctuaries at present.

Biosphere Reserves : Large tracts of protected land with multiple use preserving the genetic diversity of the representative ecosystem by protecting wild life, traditional life styles of the tribals and varied plant and animal genetic resources. India has 14 biosphere reserves.

Red Data Book : Record of threatened species of plants and animals maintained by IUCN.

Important Wild Life Projects in India :

- **Project tiger :** Started in 1973 to check depletion in population of tiger. Jim Corbett National Park.

Biodiversity Hotspots : Regions of high endemism and high level of species richness.

Endemic Species : Species which are confined to a particular region and not found anywhere else.

Exotic or Alien Species : New species which enter a geographical regions.

Bio prospecting : Exploration of molecular, genetic and species level diversity for products of economic importance.

International Efforts for Biodiversity Conservation :

- World Conservation Union (formerly IUCN) : provides leadership, common approach and expertise in the area of conservation.
- The Earth Summit : Historical convention on Biological diversity held in 1992 at Rio de Janerio, Brazil.
- The World Summit on Sustainable Development : Held in 2002 in Johannesburg, South Africa to pledge to reduce biodiversity losses at global and local levels.

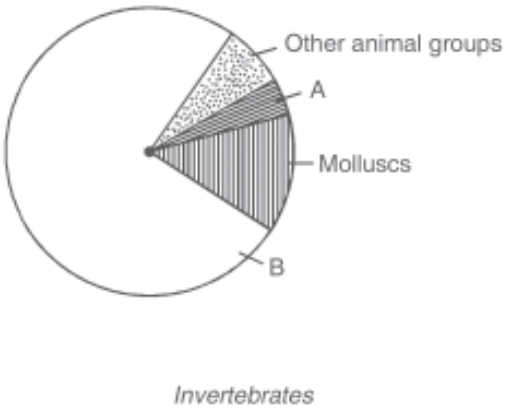
QUESTIONS

VSA (1 MARK)

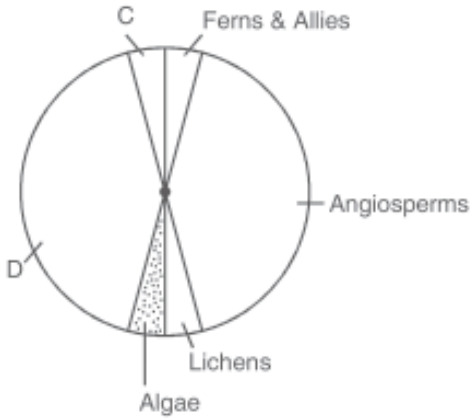
1. Habitat loss and fragmentation has caused severe damage to a particular type of ecosystem. Name it.
2. What trend is observed in respect of species diversity when we move from equator to poles?
3. Which region is considered as the one with highest biodiversity on earth? What is the name given to such region.forests?
4. Ecologists have discovered that value of ¡¥Z¡¦ lies in range of 0.1 to 0.2 regardless of taxonomic group or region. When will the slope of line steeper in species area relationship?
5. Define cryopreservation. Why is it useful in conserving biodiversity?
6. What is the reason for genetic variation shown by medicinal plant *Rauwolfia vomitoria?*
7. How many species of plants and animals have been described by IUCN in 2004? What is global species diversity according to Robert May?
8. Explain co-extinction with a suitable example.

9. Study the pie-diagram and answer the questions which follows :

What do A, B, C and D represent in these diagrams.



Invertebrates

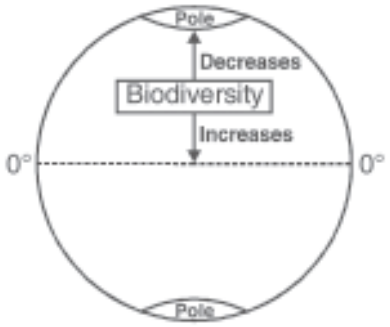


Taxa of Plants

SA-I (3 MARKS)

10. Hot spots are the regions of exceptionally high biodiversity. But they have become regions of accidental habitat loss too. Name the three hot spots of our country. Why are they called 'Hot spot'?

11. Study the diagram of the earth given below. Give the name of the pattern of biodiversity therein. Suggest any two reasons for this type of occurance.



12. What is so special about tropics that might account for their greater biological diversity?

13. Why is the sobriquet 'The Evil Quartet' used in context of biodiversity? Name the members of this quartet. Why do we grieve for the genes when a species is lost?

14. Describe at least two approaches each for ex-situ conservation and in situ conservation as a strategy for biodiversity conservation.

ANSWERS

VSA (1 MARK)

1. Tropical Rain Forest.
2. In general, species diversity decreases as we move away from the equator towards poles.
3. Amazonian rain forests. They are also called the 'Lungs of the planet'.
4. Slope of line is much steeper if one analyses the species¡Varea relationship among very large areas like entire continents.
5. Preserving a material in liquid nitrogen at – 196°C. It can be done to preserve threatened species in viable and fertile condition for long period.
6. Genetic variation might be in terms of potency and concentration of the active chemical reserpine produced by plant.

SA-II (2 MARKS)

7. IUCN (2004) has described slightly more than 1.5 million species of plants and animals.

   According to Robert May¡¦s estimates the global species diversity is about 7 million.
8. Coextinction refers to the disappearance of species with extinction of another species of plant or animal with which it was associated in an obligatory way. e.g., Plant-pollinator mutualism.
9. A → Crustaceans B → Insects

   C → Mosses D → Fungi

SA-I (3 MARKS)

10. Westerm Ghats and Sri lanka; Indo-Burma; Himalaya called ¡¥biodiversity hot spots¡¦ as they show
    (i) High level of species richness
    (ii) High degree of endemism
11. Latitudinal gradients
    (i) More solar energy available in tropics, more productivity.
    (ii) Tropical environments are less seasonal, so more predictable.

12. a) Speciation is a function of time, unlike temperate regions subjected to frequent glaciations in the past, tropical latitude have remained relatively undisturbed for million of years and thus had long evolutionary time for species diversification

b) Tropical environment are less seasonal, more constant and predictable

c) More solar energy awailable in the tropics contributing to high productivity leading to greater diversity.

LA (5 MARKS)

13. The 'Evil Quartet' is used as a sobriquet to refer to the cause of loss of biodiversity :

(i) **Habitat loss and fragmentation :** When large habitats are broken up into smaller fragments due to various human activities, the animals requiring large territories (elephants, birds etc.) are badly affected and their populations decline.

(ii) **Over-exploitation :** When need of a resource becomes greed. e.g., over exploitation of passenger pigeon led to its extinction. Also marine fish is at brink of being endangered due to over exploitations.

(iii) **Alien species invasion :** Intentional or non-Intentional introduction of a species to a nearby area may disturb the harmony of existing species. e.g., Eichhornia after introduction posed a big threat to the native species.

(iv) **Co-extinction :** Extinction of one species invariably leads to extinction of another when they are associated with each other in an obligatory way. e.g., when host species is extinct, obligate parasites dependent on it also die.

(v) We grieve for the loss of genes, because the wild forms are hardy and more resistant to pathogen attack and can be beneficial in crop breeding programmes.

14. **In situ conservation :**

(i) Identification and maximum protection of 'hot spots'

(ii) Legal protection to ecologically rich areas.

(iii) Biosphere reserves, national parks and sanctuaries

(iv) Sacred groves.

Ex situ Conservation :

(i) Creation of zoological parks, botanical garden, wild life sanctuary

(ii) Cryopreservation

(iii) Seed bank.

CHAPTER 16

ENVIRONMENTAL ISSUES

POINTS TO REMEMBER

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

Pollutants : Agents which cause pollution.

Slash and Burn Agriculture (Jhum Cultivation) : Farmers cut down trees and burn the plant remains. Ash is used as a fertiliser and the land is then used for farming or cattle grazing.

Reforestation : Process of restoring a forest that was removed at some point of time in the past.

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

CPCB : Central Pollution Control Board

BOD : Biological Oxygen Demand

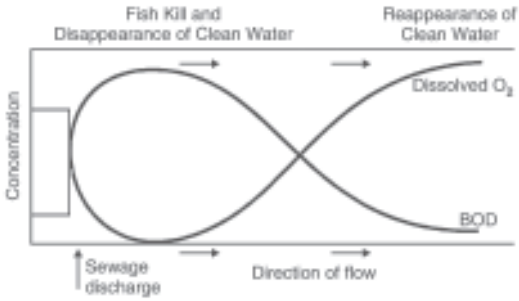
CNG : Compressed Natural Gas

FOAM : Friends of Arcata Marsh

JFM : Joint Forest Management.

Biochemical Oxygen Demand (BOD)

- BOD refer to the amount of oxygen that would be consumed if all the organic matter is one litre of water were oxidized by bacteria. The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water.
- Indirectly BOD is a measure of the organic matter present in the water. The greater the BOD of waste water, more is its polluting potential.
- In the given figure the effect of sewage on some imporant characteristic of a river is shown:



Algal Bloom : Presence of large amounts of nutrients in water causes excessive growth of algae, called an algal bloom.

Harmful effect of algal bloom are :

1. Fish mortality
2. Deterioration of water quality
3. Toxic to animals and human beings.

Biomagnification

- It refers to increase in concentration of toxic substances at successive trophic levels.
- Biomagnification of DDT in an aquatic food chain

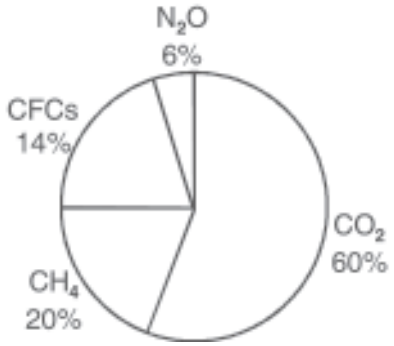
Water (0.003 ppm) → Phytoplankton (0.025 ppm) → Zooplankton (0.04 ppm) → Small Fish (0.5 ppm) → Large fish (2 ppm) → Fish eating birds (5 ppm)

Harmful Effect : High concentration of DDT disturbs calcium metabolism in birds, which causes thinning of egg shell and their premature breaking, causing decline in birds population.

Eutrophication : It the process of nutrient enrichment of water and subsequent loss of species diversity like fishes. Excess nutrients causes algal bloom which may cover the whole surface of water body and release toxins. It causes oxygen deficiency in water that leads to the death of aquatic animals like fishes.

Global Warming : Increase in the level of greenhouse gases is mainly responsible for global warming. (Increase in mean global temperature due to trapping of infrared radiation). Carbon dioxide, Methane, CFCs, N_2O are the

main gases that causes greenhouse effect.



Harmful effects of global warming :

1. Melting of glaciers
2. Over many years, this will result in a rise in sea level that can flood the coastal plains.

Measures of Control Global Warming

1. Minimise the use of fossil fuel.
2. Improving efficiency of energy usage.
3. Reducing deforestration.
4. Planting trees.

Ozone Depletion :

- ❑ Ozone gas is continuously formed by the action of UV-rays on molecular oxygen and also degraded into molecular oxygen in stratosphere.
- ❑ The thickness of the ozone-layer in a column of air from the ground to the top of the atmosphere is measured in tems of Dobson units (DU).
- ❑ Ozone layer absorbs the harmful UV-rays. These rays cause the skin cancer, damages genes, causes inflammation of cornea.
- ❑ Chlorofluro Carbons deplete the ozone layer. The part of atmosphere with lesser concentration of ozone is called ozone hole.

Steps leading to ozone depletion

- ❑ UV-rays split CFCs and release atomic chlorine (Cl)
- ❑ UV-rays also split ozone into oxygen.
- ❑ Chlorine atoms trap oxygen atoms and ozone is not formed again from oxygen. This leads to depletion of ozone in the stratosphere.

Ozone Hole : Large area of thinned ozone layer over Antartica.

Control of Vehicular Air Pollution in Delhi : All the buses of Delhi were converted to run on CNG by the end of the 2002. Other steps to reduce air pollution in Delhi include.

1. Phasing out of old vehicles.
2. Use of unleaded petrol and low sulphur petrol and diesel.
3. Use of catalytic converters in vehicles.
4. Application of Euro-IV norms for vehicles from April, 1, 2010.

Auto Fuel Policy : The Government of India has laid out a road map to cut down the vehicular air pollution in many cities of India. The goal of this policy is to reduce Sulphur to 50 ppm in petrol and diesel and reduce levels of aromatic hydrocarbons to 35% of the fuel. The Bharat Stage II will be applicable to all automobiles in all cities April, 1, 2005. The cities (like Delhi, Mumbai, Chennai, Kolkata etc.) will have to meet Euro III emission norms from April 1, 2005 and Euro IV Emission norms from April 1, 2010.

QUESTIONS

VSA (1 MARK)

1. Why should the velocity of air between the plates of an electrostatic precipitator be low?
2. PM2.5 is responsible for causing greatest harm to human health. What is it? How is it harmful?
3. What is the noise level that can cause permanent impairment of hearing ability of human beings?
4. Why was the Montreal Protocol signed?
5. Jhum cultivation has been in practice from earlier days, but its considered more problematic these days. Why?
6. A radiation causes ageing of skin, skin cancer, and inflamation of cornea called snow blindness. It also damages DNA. Name the radiation.

SA-II (2 MARKS)

7. Landfills are not much a solution for getting rid of solid wastes. Why?
8. Electrostatic precipitator can remove over 99% particulate matter present in exhaust from a thermal power plant. How?
9. Why is a scrubber used? Which spray is used on exhaust gases passing through a scrubber?
10. There is a sharp decline in dissolved oxygen downstream from the point of sewage discharge. Why? What are its adverse effects?
11. Catalytic converters use expensive metals as catalysts.
    (a) Name the metals generally used.
    (b) What precaution should be observed while using catalytic converter.
12. What are e-wastes? Why are they creating more problem in developing countries in comparision to developed countries?
13. Water logging and salinity are some of the problems that have come in the wake of Green revolution. How does water logging create problems of salinity?
14. What is the relationship between BOD, mcro-organisms and amount of bio-degradable matter?

SA-1 (3 MARKS)

15. Deforestation is creating a lot of problems in the environment. List the consequences of deforestation.
16. Enlist four harmful effects caused to the humans living in areas having polluted air. Suggest two measures to reduce air pollution.
17. People have been actively participating in the efforts for the conservation of forests.
    (i) Name the award instituted in respect of Amrita Devi to promote such efforts.
    (ii) Name the movement launched to protect the trees by hugging them.
    (iii) Name the step Government of India has undertaken in 1980's to work closely with the local communities for protecting and managing forests.

LA-(5 MARKS)

18. Pollutant released due to human activities (like effluents from industries and homes) can radically accelerate the ageing process of the water body.

    (a) Explain how does this process occurs during natural ageing of lake.

    (b) Give the term used for accelerated ageing of water bodies. Also give the term used for the natural ageing of lake.

19. In Arcata, the town's people have created an integrated waste water treatment process within a natural system. A citizen group called FOAM helps in upkeep of this project.

    (a) What are the main steps in waste water management done in this way?

    (b) 'Ecosan' in Kerala and Sri Lanka is also an intiative for water conservation. How?

20. What are the contribution of Ahmed Khan in Bangalore and Ramesh Chandra Dagar in Sonipat?

ANSWERS

VAS (I MARK)

1. To allow the dust to fall.
2. PM2.5 stands for particulate matter of size 2.5 micrometers or less in diameter. Its responsible for causing greatest harm to human health as it can be inhaled deep into lungs and cause breathing problems.
3. 150 dB or more
4. To control emission of ozone depleting substances.
5. Enough time gap is not being given for the natural process of recovery of land from the effect of cultivation.
6. Ultraviolet B rays (UV-B rays)

SA-II (2 MARKS)

7. Landfill sites are getting filled very fast due to large amount of garbage generation. Also underground water resources may get polluted due to seepage of chemicals.

8. Electrode wire at thousand volts, produce corona to release electrons, electrons attach to dust particules giving them net negative charge, charged dust particules attracted/collected by collecting plates which are grounded.

9. To remove gases like sulphur dioxide. Spray of water or lime is used.

10. Following discharge of sewage into river, micro organisms involved in biodegradation of organic matter present in sewage consume more oxygen. This cause mortality of fish and other aquatic creatures.

11. (a) Catalysts : platinum - palladium and Rhodium

    (b) Motor vehicles equipped with catalytic converters should use unleaded petrol as lead inactivates the catalysts.

12. (a) Irrepairable computers and other electronic wastes.

    (b) Recycling in developing countries involves manual participation thus exposing workers to toxic substances. In developed countries its mechanised so less dangerous.

13. Water logging draws salt to surface of soil. Salt deposited on land surface as a thin crust or at the roots of the plants.

14. Increase in amount of biodegradable matter leads to rapid multiplication of micro organisms to degrade it, thereby increasing BOD level of the water body.

SAI (3 MARKS)

15. ❑ Enhanced CO_2 concentration in atmosphere
    ❑ Loss of biodiversity
    ❑ Soil erosion
    ❑ Desertification
    ❑ Disturbed hydrological cycles.

16. Breathing problems, irritation and inflammation, Damage to lungs, Premature death.
    ❑ Reduce emission from automobile exhaust
    ❑ Growing more trees.

17. (i) Amrita Devi Bishnoi Wildlife Protection Award.
    (ii) Chipko movement
    (iii) Joint Forest Management (JFM).

18. (a) The phenomeon is eutrophication. More nutrients in water, aquatic life increases organic remains deposited on lake bottom, lake grows shallower and warmer, gradually transforms into land due to deposition of silt and organic debris.

    (b) Cultural or Accelerated eutrophication

    Natural ageing is Eutrophication.

19. (a) Conventional sedimentation, filtering and chlorine treatment. Absorption and assimilation of pollutants by algae fungi and bacteria.

    (b) 'Ecosan' derived from ecological sanitation. Handling human excreta using dry composting toilets. Its practical, hygienic and cost effective method.

20. Refer page No. 279-280, ncert Text of Biology Class XII (the benefits of polyblend and organic farming.)

CLASS-XII

MODEL PAPER-1 (Unsolved)

BIOLOGY (THEORY)

Times : 3 Hours ***Maximum Marks : 70***

General Instruction :

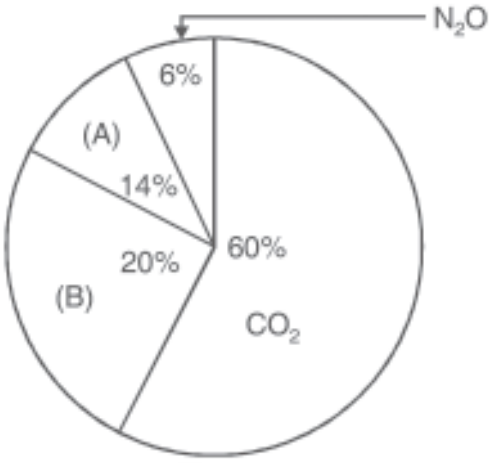
1. All questions are compulsory.
2. This question paper consists of four sections A, B, C and D. Section A contains questions of 1 mark each. Section B is of 10 questions of 2 marks each. Section C has 9 questions of 3 marks each, whereas section D is of 3 questions of 5 marks each.
3. There is no overall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

SECTION-A

1. State competitive exclusion principle (Gausse's principle).
2. 'Asexual reproduction does not produce the genetic variability'. Why?
3. Name the insecticidal protein which is produced by Bacillus thuringiensis.
4. Thorns of Bougainvillea and tendrils of Cucurbita are considered as homologous organs. Give reason.
5. Expand IUD and MTP.
6. Which category of adaptive immunity is provided by vaccination?
7. Why is male *Drosophila* fly referred to as heterogametic?
8. What is meant by juvenile phase of an organism?

SECTION-B

9. Observe the following pie-chart showing contribution of green house gases to global warming. Name the gases denoted as A and B.



10. Mention two strategies evolved by flowers to prevent self pollination.
11. What would happen to the successive trophic level in the pyramid of energy, if the rate of reproduction of phytoplankton slows down? Suggest two factors which could cause such a reduction is phytoplankton reproduction.
12. Frederick Griffith carried out his experiments on Diplococcus pnoumoniae using R-Strains and SStrains. What is meant by R-strains and S-Strains? What did he prove from these experiments?
13. List any four factors which may lead to loss of biodiversity.
14. Differentiate between convergent and divergent evolution.
15. What is single cell protein? What is the significance of such a protein?
16. Name the endocrine structure found in empty Graafian follicle. What role does it play during pregnancy?
17. What does S-Shaped pattern of population growth represent? How is J-shaped pattern different from it and why?

OR

What type of conservation measures, in situ or ex situ will help the larger number of species to survive? Explain.

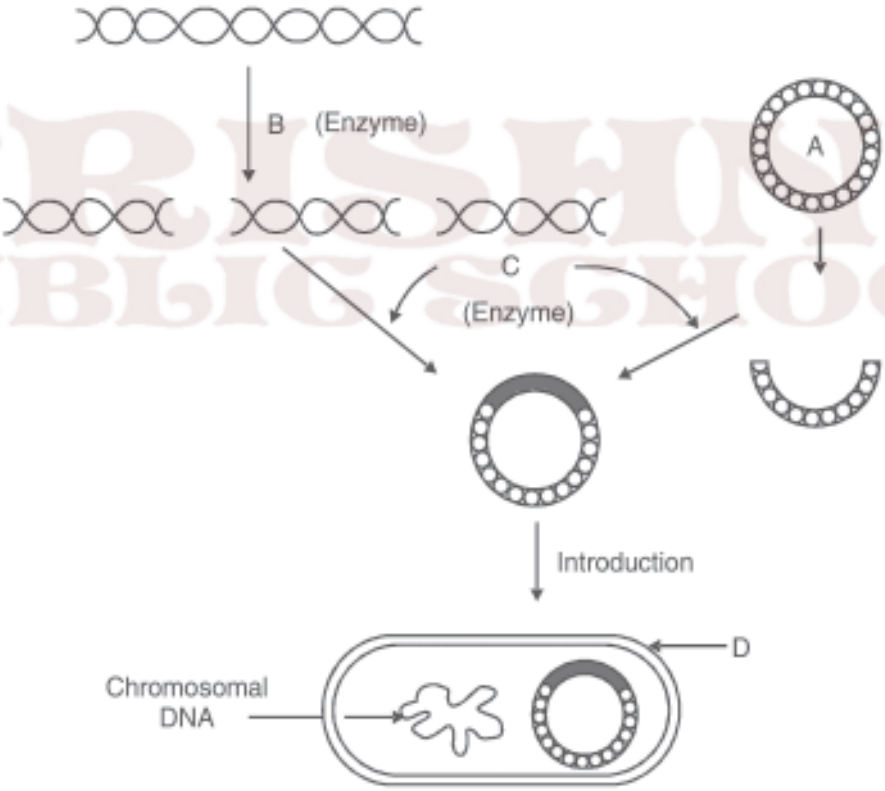
18. Fill in the blanks A, B, C and D in the following tables

S. No.	*Methods of birth Control*	*Contraceptive/device*
1.	Natural	A
2.	B	Vasectomy
3.	C	Saheli
4.	Implants	D

SECTION-C

19. The following figure represents rDNA technology. Observe the figure and give answer of th questions given below :

(a) Identify A, B, C and D (b) Write two applications of this technique.



20. In snapdragon (Antirrhinum majus) a plant with red flowers was crossed with a plant with white flowers. Work out all the possible genotypes and phenotypes of F1 and F2 generations. Comment on the pattern of inheritance in this case.

21. Describe various steps involved in the treatment of sewage before it is discharged into a water body like a river.

22. With the help of a labelled diagram, explain the typical structure of female gametophyte of an angiosperm.

23. What is an operon? Who first proposed this concept? Describe the major steps involved in lac operon.

24. A sperm has just fertilised a human egg in the fallopian tube. Trace the events that the fertilised egg will undergo upto the implantation of the blastocyst in the uterus.

OR

Briefly describe the stages of spermatogenesis in humans.

25. Describe how nematode resistant transgenic plants have been produced.

26. How did Urey and Miller prove the abiotic synthesis of organic molecules that must have been formed on the primitive earth? Name any two such molecules obtained?

27. Represent diagrammatically the E. Coli cloning vector pBR 322.

SECTION-D

28. (i) What are allergens? Give an example.

(ii) Write two common symptoms of allergy.

(iii) Write the full name of the organism that causes AIDS. Mention the category of people who are at high risk of getting this disease.

OR

(i) What is a protoplast?

(ii) Name the two enzymes used in producing protoplasts.

(iii) Describe the steps in producing somatic hybrids from protoplasts.

(iv) Mention the usefulness of somatic hybridisation.

29. (i) Represent the change of base (point mutation) that causes sickle cell anaemia. Represent diagrammatically the HbA and Hbs polypeptides.

(ii) Write two symptoms exhibited by Turner's syndrome sufferer. Explain the cause of this disorder.

OR

Describe in detail the steps involved in th technique of DNA fingerprinting.

30. (i) Define decomposition and describe the process of decomposition.

(ii) Draw schematically the phosphorus cycle in nature.

OR

(i) Describe in detail the species area relationship regarding biodiversity.

(ii) The Amazonian rain forest in South America has the greatest biodiversity on earth sustainable with numbers of different species of organisms. Give reasons.

CLASS-XII

MODEL PAPER-1 (Solved)

BIOLOGY (THEORY)

Times : 3 Hours ***Maximum Marks : 70***

General Instruction :

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

SECTION-A

1. When does an oocyte complete oogenesis? When does oogenesis begin in a human female?
2. Which organisms are usually the pioneer species in a (i) Hydrarch and (ii) Xerarch succession?
3. Give an example to show how the same species can occupy more than one trophic level in the same ecosystem.
4. Cucurbits and coconut bear unisexual flowers but are monoecious. Why?
5. Define allelomorphs.
6. DNA in chromosomes also replicates semi-conservatively. How did Taylor and colleagues prove it?

7. Besides converting the milk to curd, which are the two other roles played by LAB?

8. What are baculoviruses?

SECTION-B

9. (i) Very small animals like shrews and humming birds are rarely found in Polar Regions. Why?

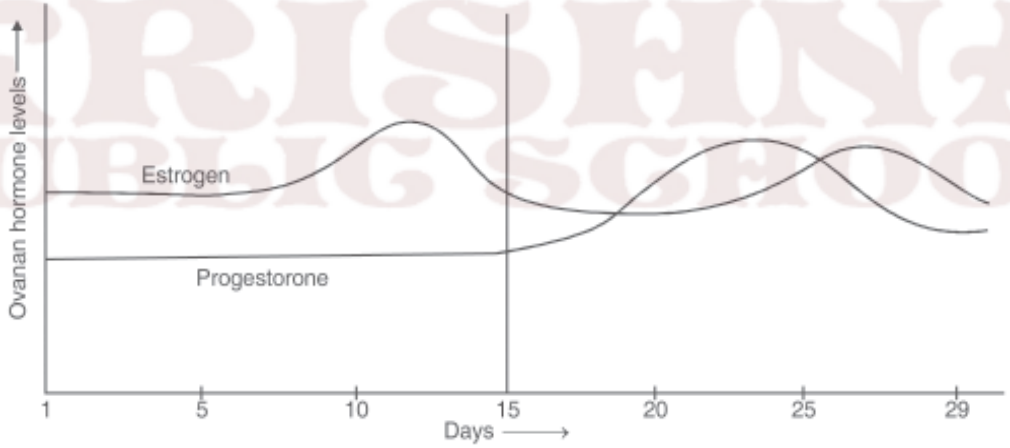
   (ii) Define Diapause.

10. Read the graph given below and correlate the uterine events that take place according to the hormonal levels on

   (i) 6-15 days

   (ii) 16-25 days

   (iii) 26-28 days (if ovum is not fertilized)



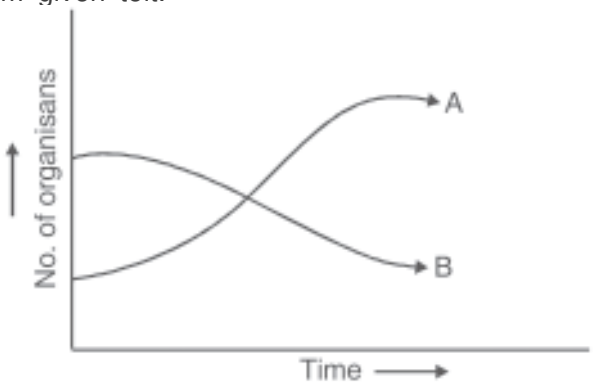
11. Draw the structure of initiator t-RNA molecule. Why is t-RNA called as an adapter molecule?

OR

Lactose plays a dual role in the lac-operon. How? Why is lac-operon said to be under negative regulation?

12. (a) The graph below represents the growth patterns of two types of aquatic organisms over a brief period of time in a water body surrounded by an agricultural land extensively supplied with fertilisers. Identify the organisms that would represent (i) A and (ii) B.

(b) State the reason for such a change in the water body and also write the term given toit.



13. How do Cu 7 or Multiload 375 and Progestasert or LNG-20 differ in their contraceptive action?
14. Inbreeding is necessary and useful in some cases. How? Name the problem which can be caused due to close inbreeding and the way to get rid of the problem.
15. α-Interferons are helpful in controlling a very fetal disease. Name the disease and ways to detect it. How do the α-interferons help in such cases?
16. How is a divalent cation like Calcium useful in making the host cell competent for transformation with rDNA? What is biolistics?
17. Approval of which organization is needed for getting a clearance for mass production of a genetically modified organism? What can be the any two possible reasons for the need of such organization?
18. IgE antibodies are usually produced in response to certain substances. What are such substances called? What is the condition caused due to such substance and mention the cell and its chemical which causes such condition?

SECTION-C

19. An ecologist wants to explore an area with a higher biodiversity. Suggest whether he/she should explore a tropical region or a temperate region? Why?
20. Million of gamete mother cells have been formed in the fetal ovary of a human female. Trace the events which will follow till the formation of mature female gamete (Ovum).
21. Explain with a suitable example the phenomenon of incomplete dominance.
22. Draw the schematic structure of a transcription unit. What is the convention in defining the two strands of DNA in such case? What will

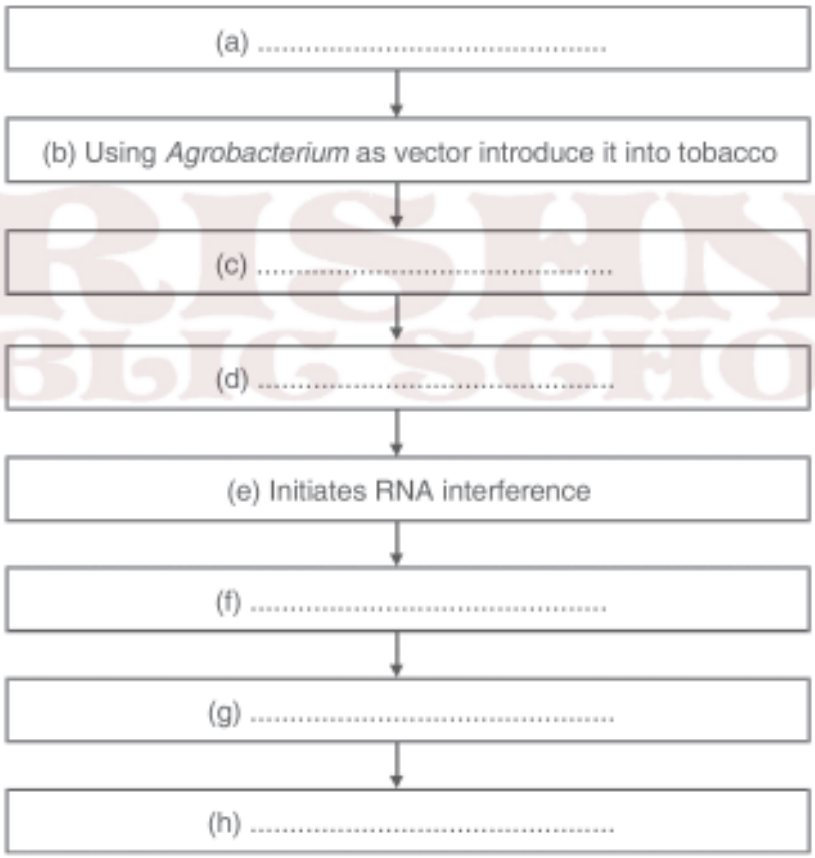
be the bases in the coding strand if template strand reads 3'-ATGCATGCATGCATGCATGCATGC-5'?

23. Using algebraic equations prove that the frequency of occurrence of alleles of a gene or a locus is fixed and remain same for generations in a given population. Who proposed this? What factors effect it?

24. Explain the working of Sewage treatment plants and define primary sludge, flocs and activated sludge.

25. With the help of a flow chart show the multiplication of a retrovirus which can cause a deficiency of immune system which is acquired during life time of an organism.

26. Write the missing steps in the following flowchart :



OR

What are the features of cloning vectors? How will you distinguish recombinants from nonrecombinants?

27. Explain with reference to PCR

(a) A specific enzyme helps in amplification in PCR. Name the bacterium from which it is isolated and state how its thermostable nature is helpful.

(b) Explain its use in molecular diagnosis

SECTION-D

28. Domestic and sewage effluents can cause algal bloom, biomagnification, eutrophication. How? What effect does it have on BOD? What is cultural eutrophication?

OR

How is the "sixth episode of extinction" of species on earth, now currently in progress, different from the five earlier episodes? What is it due to? Explain the various causes that have brought about this difference.

29. (a) Explain the process of megasporogenesis.

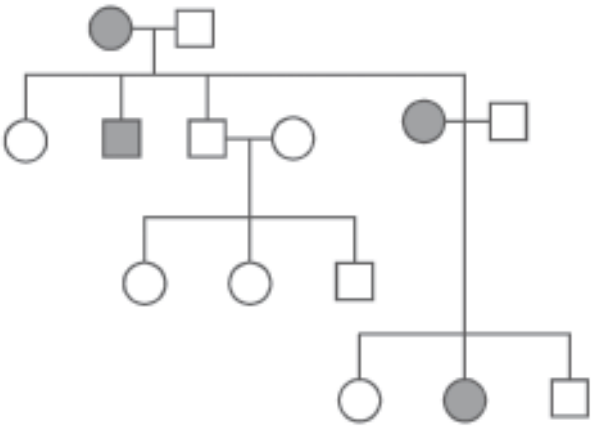
(b) Name any three outbreeding devices. What is self incompatibility?

OR

Show diagrammatically the stages of embryonic development from zygote upto implantation in humans.

30. (a) Show diagrammatically the results of dihybrid cross carried out by T.H. Morgan to show linkage.

(b) What is pedigree analysis and its use? What will be the genotype of each of the individuals in the following pedigree chart :



OR

(a) Explain the technique in which VNTRs can be used in ascertaining the genetic diversities.

(b) What are the differences between prokaryotic and eukaryotic transcription?

CLASS-XII

SAMPLE PAPER-1 (Solved)

ANSWERS

SECTION-A

1. Oogenesis completed when sperm comes in contact with zona pellucida of ovum. Oogenesis is initiated during embryonic development.
2. **Hydrarch Succession :** Usually small phytoplanktons.

   Xerarch Succession : Usually lichens.
3. Sparrow is primary consumer when eats seeds and secondary consumer when it eats worms.
4. They are Monoecious as both male and female flowers occur on same plant.
5. **Allelomorphs :** Various or slightly different forms of a gene having same position on chromosome.
6. Used radioactive thymidine on DNA of chromosomes in Vicia faba.
7. (i) Improves nutritional quality by increasing vitamin B12
   (ii) Check disease causing microbes.
8. **Baculoviruses :** Pathogens that attack insects and arthropods.

SECTION-B

9. They have large surface area relative to their volume so lose body heat very fast in colder regions. Hence, occur rarely in polar region.

   Diapause : A stage of suspended development shown by many zooplanktons in lakes and ponds.
10. (i) Regeneration of endometrium.
    (ii) Uterus gets high vascularised, ready for embryo implantation.
    (iii) Disintegration of endometrium.

11.

Adapter molecule because

(i) on one hands reads the code,

(ii) on the other hand binds to specific amino acid.

OR

Lactose plays as inducer as well as subsrate in the lac-operon. Lac-operon is under negative regulation as the presence of repressor prevents the transcription in the operon.

12. a (i) Water hyacinth/algal growth

(ii) Fish/Aquatic animals.

b (i) Excessive growth of algae triggered by nitrates and phosphates from agricultural land run off water.

(ii) algal bloom/eutrophication

13. Cu7 and Multiload 375 $\rightarrow$ copper releasing IUD's

Progestasert, LNG - 20 $\rightarrow$ hormone releasing IUD's

Both increase phagocytosis of sperm and affect sperm motility. Hormone releasing also make uterus unsuitable for implantation and cervix hostite to the sperms.

14. Inbreeding

(i) increases homozygosity, so helps in creating pure lines,

(ii) exposes lethal genes.

Problem Caused : Inbreeding depression.

Remedy : Mating with unrelated superior animals of the same breed.

15. **Disease :** Cancer

Ways to Detect : Biopsy, MRI, Radiography, CT α-interferons activate immune system and helps in destroying the tumor.

16. Divalent cations increases efficiency with which DNA enters the bacterium through pores in its cell wall.

    Biolistics : Bombarding the cells with high velocity micro particles of gold or tungsten coated DNA.

17. **GEAC :** Genetic Engineering Approval committee

    - ❑ to check validity of GM research,
    - ❑ to ensure safety of introducing GM organisms for public services.

18. IgE are produced against allergens.

    Condition is called allergy.

    Mast cells cause the allergic response by secreting histamine and serotonin.

SECTION-C

19. He should explore tropical region because tropical regions have higher diversity due to :

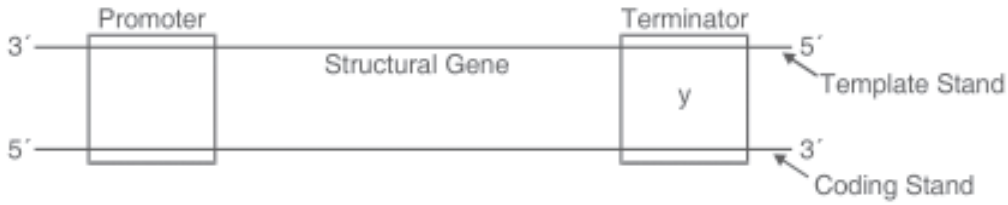
    (i) More speciations as remained undisturbed for millions of year.

    (ii) Less seasonal so more niche specialisation for species.

    (iii) More solar energy so more productivity.

20. Refer figure 3.8(b), NCERT-Bio text book class XII on page no. 49.

21. Refer Page 76 NCERT–Bio Text Book



Convention : All reference point while defining a transcription unit is made with respect to coding strand. Promoter region is towards 5´ end of coding strand. Coding Strand 5´ TACGTACGTACGTACGTACG 3´

23. Sum total of all allelic frequencies is one.

    Let p and q represent the frequency of alleles A and alleles 'a' respectively. So p + q = 1. for a monohybrid cross, the frequency of AA is p^2 and 'aa' is q^2 and that of Aa is 2 pq.

    Hence, $p^2 + 2pq + q^2 = 1$

This is a binomial expansion of $(p + q)^2$

i.e. it remains constant at 1.

❑ This was proposed by Hardy and Weinberg.

❑ Gene flow, genetic drift, mutation, genetic recombination and natural selection effect it.

24. Refer page 184, NCERT - Biology Class XII.

25. Fefer fig 8.6, page 155, NCERT - Biology Class XII.

26. (a) Isolate nematode specific genes.

(b) Produces sense and anti sense RNA in host cells.

(c) Forms double stranded RNA (due to being complementary).

(d) Silence the specific mRNA of the nematode.

(e) Transgenic tobacco plant is protected against nematode.

❑ **Features of Cloning Vectors**

(a) Ori site (b) Selectable marker (c) Cloning sites.

❑ Recombinant and non-recombinants can be distinguished by using insertional inactivation method in which recombinant DNA is inserted in coding sequence of an enzyme β-galactosidase.

This results into inactivation of the enzyme. Presence of chromogenic substrate gives blue coloured colony if plasmid does not have an insert but no colour is produced if insert there (as β-galactosidase becomes inactivated).

27. (a) *Taq* polymerase obtained from bacterium called as Thermus aquaticus.

(b) Very low concentration of bacteria or virus can be detected by amplifications of their nucleic acid by PCR.

28. ❑ Refer page 276, NCERT - Class XII, Biology.

❑ It increases the BOD of water.

❑ Human activities have accelerated the rate of eutrophication. This is called cultural eutrophication.

OR

❑ Its occuring at a faster rate.

❑ Its due to human activities.

❑ Causes are

(i) Habitat loss and fragmentation

(ii) Over exploitation.

(iii) Alien species invasions.

(iv) Co-extinctions

Refer page 264, NCERT-Bio Class XII

29. ❑ Refer page 25-27, Class XII-NCERT (Biology).

❑ Three outbreeding devices

(a) Pollen release and stigma receptivity are not synchronised.

(b) Anther and stigma are placed at different position.

(c) Self-incompatibility.

Self-Incompatibility : Genetic mechanism which prevents self pollen from fertilising the ovule by inhibiting pollen germination or pollen tube growth in the pistil.

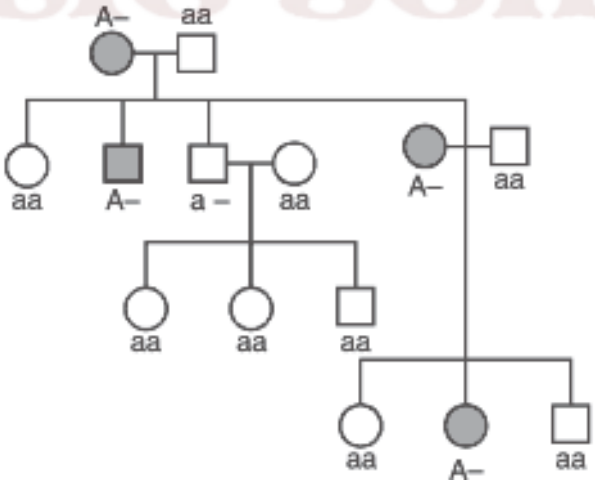
OR

Refer Fig 3.11, page 52, NCERT-Biology Class XII.

30. (a) Refer Fig. 5.11. page 84-Biology Class XII

(b) Analysis of traits in several of generations of a family is pedigree analysis.

Use : To trace inheritance of a specific trait, abnormality or diseases.



(a) The process/technique is DNA fingerprinting (Refer page No. 122, NCERT-Biology Class XII).

(b) Refer page No. 110-111, NCERT-Biology, Class XII.

CONTENTS

Details of the concept to be mastered by every child of class XII with concepts and exercises of NCERT Book.

Symbols used

*** Important Questions * * Very Important Questions**

*** * * Very-very Important Questions**

CHAPTER	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
Reproduction In Organisms	Types of reproduction A) Asexual reproduction B) Sexual reproduction, phases and events in sexual reproduction	* * *	NCERT text book xii fig . 1.2(a) (b) fig. 1.3, 1.4 page 5-8 NCERT book p – 15 - 19 ex q 2,6,9,13,15,18	fail to differentiate asexual reproductive structures- zoospores, conidium, gemules etc. differentiation in monoecious & diocious
Sexual Reproduction In Flowering Plants	1. Pre fertilization: structures and events (i) stamens microsporangium & pollengrain microsporogenesis (ii) pistil megasporangium (ovule) embryosac- megasporogenesis 2) pollination (i) autogamy , xenogamy, geitnogamy (ii) agents of pollination (iii) out breeding devices (iv) pollen pistil interaction 3. Double fertilization 4. Post fertilization : structures & events – endosperm , embryo, seed 5. Apomixis - polyembryony	* * * * * * * * * * * * *** * * *	NCERT book fig 2.2. 2.3 , 2.5 p – 21 – 23 NCERT book fig 2.7(d) 2.8 p – 24 – 27 NCERT book p – 27 – 28 NCERT book p – 31 – 33 NCERT book p – 34 fig 2.12. (c,d,e)	no. of cells in mature pollengrains no. of cells & nuclei in embryo sac , role of synergids self incompatibility triple fusion free nuclear & cellular endosperm, embryo of monocot

			fig – 2.13, 2.14, 2.15 p – 35 NCERT p – 38 NCERT	fail to differentiate apomixes , parthenocarpy
Human Reproduction	1 male reproductive system (i) diagram & description (ii) parts of male reproductive system (structure) (iii) functions of parts of system (iv) accessory ducts (v) accessory glands	* * * * * * * * *	NCERT P – 43 , FIG 3.1 (B) NCERT P – 43-44 NCERT P – 43-44	Exact Location & Function Of Leydig Cells & Sertoli Cells
	2. Female reproductive system (i) diagram & description (ii) parts of female reproductive system (structure) (iii) functions of parts of system (iv) accessory ducts (v) uterus & its layers (vi) mammary glands	* * * * * * * * *	NCERT P – 44- 46 , FIG 3.3 (B) -DO- NCERT P – 44-46 NCERT P – 44 NCERT P – 46 NCERT P – 47	
	3 gametogenesis (i) spermatogenesis & diagram (ii) stages of spermatogenesis with names of cells & no of chromosomes (iii) structure of sperm	** * ***	NCERT P – 47 FIG – 3.2 & 3.5 , 3.8 (a) P – 49 Page no 47	Exact Stage Where Meiosis I & Ii Occurs During Gametogenesis As Well As The Ploidy Of Cells At Each Stage Of Gametogenesis

	(diagram) (iv) functons of each part of sperm & organelles (v) composition of semen	*** *** **	Fig 3.6, page no 48 page no 48 page no 48	
	4 oogenesis i)structure and description ii) development of follicles iii) stages with names of cells and no. of chromosomes with events iv) significance of polar bodies	 *** ** *** ***	Fig 3.7 ,Fig 3.8(b) Page no 48-49 Page no48-49 Page no48-49	Difficulty in relating different stages of oogenesis with different life stages.
	5 menstrual cycle (i) menarche and menopause (ii) phases of menstrual cycle with diagram (iii) role of hormones in cycle	 * ** ***	 Page no – 49, 51 Fig 3.9	Co-relation of levels of pituitary hormones and events during menstrual cycle
	6 fertilization and implantation (i) structure of ovum (ii) cleavage- formation of morula and blastula (iii)implantation- meaning, stage and site (iv) sex determination in humans (v) three germ layers	 * * * * * * * * * *	 Fig – 3.1, Page no – 51 Fig – 3.11 Page no – 52 Page 53 Page 52 Page 54	Labelling of mature graafian follicle
	7 pregnancy and embryonic development (i) placenta as endocrine gland (ii) embryo and extra-embryonic layers	 * * * * *	 Page 53 Fig – 3.12 Page 53	
	8 parturition (i) meaning (ii) foetal ejection reflex (iii) Role of hormones	 * *	 Page no – 54	 Hormones involved at the time of parturition
	9 lactation Meaning, colostrum and its importance	 *	 Page no – 54	
Reproductive Health	1. Reproductive health (i) Problems & Strategies	 **	 Page 57-58	 Amniocentesis

	2. Methods of birth control 3. Infertility – Corrective treatments 4. Sexually transmitted diseases	*** ** ***	Page 59-61 Page 64 Page 63	Specific site for transplantation of embryo in GIFT and ZIFT
	5methods of birth control (i) natural methods (ii) barrier methods (iii)IUDS (iv)oral contraceptives (v) injections and implants (vi)surgical methods	**	Page66	
Principles of inheritance and variations	1. Mendel's laws of inheritance (i) Reasons for choosing garden pea (ii) Seven contrasting traits of pea plant (iii) Symbols and terms used in mendel's experiment (iv) Steps involved in mendel's experiments (v) Monohybrid cross (vi) Test cross (vii) Incomplete dominance (viii) Codominance and multiple alleles (ix) Dihybrid cross 2. Chromosomal theory of inheritance 3. Linkage and recombination 4. Sex determination in animals 5. Mutations 6. Genetics disorder (i) Pedigree analysis (ii) Mendelian disorders (iii) Chromosomal disorder	 * ** ** * *** *** *** *** *** ** ** *** ** *** ***	 Page 11/7 of Pradeep's Textbook Fig 5.1 page 70—71 Page 71-73 Page 70-71 Page 71-75 Fig 5.5 74-75 Fig 5.6 page Table 5.3 page 77-78 Fig 5.7 page 79 Table 5.3 fig 5.8-5.9 Page 83-84 Fig 5.12 page 85-86 Page 87 Page 87-88 fig 5.13, 5.14	 Gamete formation in dihybrid cross Heterogametey in sex determination Use of symbols for autosomal and sex linked disorders

			Page 89-90 Page 90-91	
Molecular basis of inheritance	1. DNA (i) structure and salient features (ii) packaging of DNAhelix 2. Search for genetic material (i) transforming principle (ii) Hershey and Chase experiment (iii) properties of genetic material 3. Replication – experimental proof 4. Transcription (i) transcription unit (ii) type of RNA and process of transcription 5. Genetic code (ii)Mutations and Genetic Code (iii) tRNA-The adapter Molecule 6. Translation 7. Regulation of Gene Expression (i) Levels of Regulation (ii) The lac operon 8. Human Genome Project 9. DNA Finger printing	** ** *** *** ** *** *** *** ** ** *** **** * **** *** ****	Page no. 96-98 Fig 6.4 page 99 Page 100-101 Fig 6.5 Page 102 Page 103 Fig 6.7, 6.8 page 105-107 Fig 6.9, page 107-108 109-111 page 112 Page 113 Fig. 6.12 Page-114 Fig. 6.13 Page 115	Polarity of two stands Histone and non histone chromosomal protein Differentiation between transformation and transaction Leading and lagging strand direction Polycistronic, monoistronic, capping, taling Frame Shift and Point mutation Charging of tRNA

			Page 115 Fig. 6.14,Page 116,117 Page118-120 Fig. 6.16 Page 121-122	 Expresses Sequence Tags Sequence Annotation BAC/YAC Satellite DNA,VNTR
Evolution	1. Origin of Life 2. Evidences of Evolution 3. Adaptive Radiation 4. Biological Evolution 5. Mechanism of Evolution 6. Hardy-Weinburg Principle 7. A Brief Account of Evolution 8. Origin and Evolution of Man	* ** **** * ** *** * 	Fig 7.1 Fig. 7.3 Page 130-132 Fig. 7.5,7.6,7.7 Page 133 Page 134 Page 135 Fig. 7.8 Page 136-137 Fig. 7.9,7.10 Fig. 7.11 Page 140	 Branching Desent and Natural Selection Darwinism versus de-Vries- -Saltation Hardy-Weinburg Equlibrium,Founder Effect
Human Health & Diseases	1.Common Diseases in human 2. Immunity (i) Innate immunity (ii) Aquired immunity (iii) Active and Passive immunity (iv) Vaccination and immunity (v) Allergy (vi) Autoimmunity (vii) Immune System of Body 3. AIDS 4.CANCER 5. Drug and alcohol abuse (i) Adolescence and drugs	** ** *** * ** * **** *** ****	 Fig. 8.1 Page 146-149 Page 150-154 NCERT Fig. 8.4 Fig 8.6 Text 156 Text Page 156-158 Text Page 158-163	 Specific Role of histamines and serotonins Mucosal associated lymphoid Tissue MALT Contact Inhibition

Strategies for Enhancement in food Production	1. Animal husbandry (i) Management of farm and farm Animal (ii) Animal Breeding (iii) Bee Keeping (iv) Fisheries 2. Plant breeding (i) Method (ii) For disease Resistance (iii) For Pest Resistance (iv) For Improved food quality 3. Single cell Protein 4. Tissue Culture	 * ** ** * ** *** *** ** *** **	 Page 165-170 Text Page 170-176 Text Page176 Text Page 177 Text	
Microbes in Human Welfare	1. Role of Microbes in:- (i) House Hold (ii) Industrial Product (iii) Sewage Treatment (iv) Production of Bio Gas (v) As Biocontrol Agent (vi) As Biofertlizers	 * *** ** * *** ***	 Text Page 181 Page 182,183 Ex. Question 12 Page 184-185 Ex. Question 7,8,11 Page 185 Page 186-187 Page 188	
Biotechnology principles and processes	1. Principles of biotechnology (i) techniques used in modern biotechnology (ii) genetic engineering includes recombinant DNA, gene cloning, gene transfer (iii) meaning and use of plasmid, restriction enzymes (iv) basic steps for GMO 2. Tools of Recombinant DNA Technology 3. Cloning Vectors 4. Processes of Recombinant DNA Technology – Steps	* * * *** *** ***	NCERT text book xii fig . 1.2(a) (b) fig. 1.3, 1.4 page 5-8 NCERT book p – 15 - 19 ex q 2,6,9,13,15,18 Fig. 11.1-	 Pallindromic sequences Distinction between transformants and recombinants Diagram of pBR322 Selectable marker

			11.2-11.3 Page-195-198 Fig. 11.4 Page-198-200 Fig. 11.6,11.7 Page 201-205	
Biotechnology and its applications	1. Applications of Biotechnology in agriculture (i) Advantages of GMO (ii)Bt Cotton (iii) RNA interference 2. Applications of Biotechnology in Medicines (i) Genetically engineered insulin. (ii) Gene Therapy-ADA (iii) Molecular Diagnosis of diseases. 3. Transgenic animals 4. Ethical issues , Biopiracy	* ** *** *** *** *** ** ** *	Page 207-208 Page 208 Page 208-209 Page 209-210 Page-210-211 Page 211 Page-212 Page-213 Page-214	Differentiation of Cry and cry nRNA silencing , nematode – Meloidegyne incognitia Steps in production of insulin Role of Biotechnology in molecular diagosis.
Organisms and Populations	1. Organisms and its Environment (i) Major Abiotic Factors (ii) Responses to Abiotic Factors (iii) Adaptations 2. Populations:- (i) Population Attributes (ii) Population Growth (iii) Life History variation (iv) Population interactions	** ** *** *** *** * **	Page -221-223 NCERT Fig. 13.3 Page 223-225 Page 225-226 Fig. 13.4 Page 226-228 Fig. 13.5 Page 228-231 Page 231-232 Table 13.1 Page 232-238	Eurythermal & stenothermal Conformers, Regulators Distinction between Expanding, stable, declining population. Distinction between Exponential and Logistic growth curve. Distinction between commensalisms and Amaensalism.

Ecosystem	1. Structure and function 2. Productivity 3. Decomposition 4. Energy Flow 5. Ecological Pyramids 6. Ecological succession 7. Nutrient cycling	 * ** ** *	Page 242 Ex Q. 9 Fig. 14.1 Page 243-244 Ex. Q10 Page 245,247 Ex. Q. 11 Fig. 14.4 Page 248 Fig. 14.5 Page 250-251 Fig. 14.6 Page 253-255 Ex. Q. 12,13	 GPP,NPP
Biodiversity and Conservation	1. Patterns of Biodiversity 2. Importance of species diversity to ecosystem. 3. Loss of Biodiversity 4. Conservation of Biodiversity	*** * *** ***	Fig. 15.1 Text page 259 Ex. Q 3 Page 263 Page 264-265 Ex. Q. 5 Page 265-267 Ex. Q. 7	Graphical representation , species area relationships Cryopreservation

Environmental issues	1. Air Pollution and its control (i) Case study of Delhi 2. Water pollution and its control (i) Domestic Sewage & Industrial effluents (ii) Algal Bloom (iii) BOD (iv) Eutrophication (v) Biomagnification 3. Solid waste (i) Case study of remedy for plastic waste. (ii) Electronic waste 4. Ago chemicals & their effects (i) Case study of organic farming 5. Radioactive wastes 6.Greenhouse effect and Global Warming (i) Green house gases & their relative contribution to total global warming 7. Ozone depletion in Stratosphere 8. Deforestation:- Case study of conservation.	** *** ** *** *** *** *** *** *** * ** *** *** **	Fig. 16.1 Page 270-273 Page 272-273 Page-274 Fig.16.2,16.3 Page 275 Page- 275 Page-276 Fig. 16.5 Page-276 Page-279 Page-280 Page-280 Page-280-282 Fig. 16.6,16.7 Page-282-283 Page-284-285	Advantages of CNG over Petrol or diesel. Norms of Air Pollution. Types of impurities & their nature in domestic sewage. Effect of Sewage discharge on characteristics of river Concentraion of toxic substances at various trophic levels Types of e-wastes & the metals extracted. Role of UV-B radiations

Chapter – 1 - REPRODUCTION IN ORGANISMS

CHAPTER	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
Reproduction In Organisms	Types of reproduction C) Asexual reproduction D) Sexual reproduction, phases and events in sexual reproduction	* * *	NCERT text book xii fig . 1.2(a) (b) fig. 1.3, 1.4 page 5-8 NCERT book p – 15 - 19 ex q 2,6,9,13,15,18	fail to differentiate asexual reproductive structures- zoospores, conidium, gemules etc. differentiation in monoecious & diocious

Definitions:

- **CLONE** :- Offspring from single parent, Morphology and genetically similar individuals.
- **CYST** :- Hard covering around the organism protecting from anti environment.
- **DIOECIOUS :-** It is the condition in which either male or female reproductive organs are found in the same body of an organism.
- **EMBRYOGENESIS :-** It is the process of development of embryo from the zygote..
- **FERTILIZATION** :- The union of two opposite types of gametes, spermatozoa and ova to produce single diploid zygote.
- **FISSION** :- Division of nucleus with cytoplasm.
- **FRAGMENTATION** :- Division of breaking into distinct pieces each of which can produce an offspring.
- **GEMMULE** :- The parent individual releases a specialized mass of cells enclosed in a common opaque envelope called the gemmule.
- **HERMAPHRODITE :-** Organisms which have both male and female reproductive organs in the same individual.
- **HOMOGAMETES :-** When the two gametes of male and female are so similar in appearance that it is not possible to categorize them into male and female gametes.
- **JUVENILE PHASE :-**Juvenile Phase represents the period of an organism from birth upto reaching reproductive maturity.
- **LIFE SPAN** :-The period from birth to the natural birth of an organism.
- **MEIOCYTE ;-** The cell which undergoes meiosis is called a meiocyte .
- **MONOECIOUS :-** It is the condition in which male and female reproductive organs are found in the same body of an organism.
- **PARTHENOGENESIS :-**The female gamete undergoes development to form new organisms without fertilization.
- **REPRODUCTION** :-Biological process in which an organism gives rise to young ones of its own kind.
- **SYNGAMY :-** Syngamy refers to the fusion of two (male and female) gametes.
- **VEGETATIVE PROPAGATION** :-It is the process of formation or regeneration of new plants from a portion of a vegetative part of the plant .

Differences

External fertilization	Internal fertilization
1. This is fusion of gametes (syngamy) outside the body 2. The progeny formed are extremely vulnerable to predators. eg. bony fishes and amphibians	1. It is the fusion of gametes inside the body of mother. 2. They are well protected hence the chances of more survival of young ones. eg. reptiles

Menstrual cycle	Oestrous cycle
1. It is the cyclic change that takes place in reproductive organs of primate females 2. Menstruation takes place at the end of cycle in the absence of fertilization. 3. Copulation takes place in any season. 4. Eg. humans	1.It operates in the non primate females 2. No menstruation take place at the end of cycle 3. Copulation takes place in heat period. 4. Eg. cow, deer

•

Seasonal breeders	Continuous breeder
1. There are some animals/ mammals which possess the changes in reproductive organs only during favourable conditions. 2. They reproduce only in a particular season of year eg. Dogs and rats	1. These are the mammals which possess changes in their reproductive organs throughout their reproductive phase. 2. They reproduce during any time of the year. Eg. Humans

•

Oviparous	Viviparous animals
1. The animals which lay fertilized or unfertilized eggs. 2. The development takes place outside the body eg. Reptiles and birds.	1. These animals give birth to young ones. 2. The development takes place inside the body eg. Mammals.

ASSIGNMENTS

LEVEL-1

1. **What is meiocyte?**
2. **Name the structure which gets transformed into seeds at maturity.**
3. **Show diagrammatically only reproduction in yeast.**
4. Name two animals having external fertilization. Why are more gametes produced by such animals?

LEVEL 2

1. Why are the date palms referred to as dioecious?
2. Name any one animal in which self-fertilization occurs.
3. Differentiate between: External Fertilization / Internal fertilization, Zoospore / zygote, Gametogenesis / Embryogenesis.
4. What is special in flowering bamboo?

5. Write the mode of asexual reproduction in the following organisms:

Penicillium, Spongilla, Paramoecium, Yeast, Chlamydomonas, Amoeba.
6. Why are the date palms referred to as dioecious ?

7. What do the following parts in a flower form after fertilization?

a. Zygote,

b. ovule,

c. ovary-wall,

d. Petal

LEVEL 3

1. What are the three major phases in the life cycle of organism? Define each phase
2. Discuss the similarities in pattern of sexual reproduction.
3. Name the kind of reproduction in bees by which drones are produced?
4. If the diploid number of chromosomes in an angiosperm plant is 28, what number would you expect in the endosperm and embryo of that plant?
5. Give the scientific terms for the following
   a. Morphologically and genetically similar individual derived through asexual reproduction.
   b. Cyclical changes shown by seasonal breeders.
6. What is the site of origin of new plantlets in the followings ?

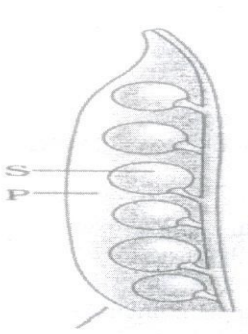
a) Potato tuber,

b) rhizome of ginger,

c) leaves of bryophyllum,

d) stem cutting of sugar cane

7. Label S & P shown in the Figure and state one function each.



8.Arrange the following events in proper sequence:-
(i) (a) Embryogenesis (b) fertilization (c) Gametogenesis (d) Zygote formation
(ii) Mention two processes taking place in embryogenesis?
(iii) What will happen if meiosis does not take place during gametogenesis?

SELF EVALUATION ASSIGNMENT

1. Single celled organisms are considered immortal. Justify the statement taking the example of amoeba.
2. Which ability of plants like banana and bryophyllum is exploited by gardeners & farmers for theit commercial propagation.
3. All papaya and date palm plants produce flowers yet only few papaya and datepalm are seen to produce fruits. Suggest the possible reason for the rest not producing then.
4. in nature for both plants and animals hormones are responsible for transition between the three phases of their life span. Which three phases are being refer to here. What regulates the reproduction process and the associated behavioral expression in them?
5. Name the process of development of embryo from zygote. What are the two changes which the zygote undergoes during this process.
6. i)Name a group of plants that has haploid body
   ii)what are the specialized cells which undergo meiosis in the diploid organisms.
7. (i) In bisexual flowers why is transfer of pollen grains easier than in the unisexual flowers?
   (ii) Name the specialized event in unisexual flowers which helps in transfer of pollen.
   (iii)How are the non-motile male gametes carried to the female gamete in seed plants?
8. Why Dogs and cats have oestrus cycle but human beings have menstrual cycle, through all are mammals? Why some mammals are called seasonal breeders?
9. Arrange the following events in proper sequence:-
   (i) (a) Embryogenesis (b) fertilization (c) Gametogenesis (d) Zygote formation
   (ii) Mention two processes taking place in embryogenesis?
   (iii) What will happen if meiosis does not take place during gametogenesis?

Chapter – 2
SEXUAL REPRODUCTION IN FLOWERING PLANTS

Sexual Reproduction In Flowering Plants	3. Pre fertilization: structures and events	* * *		
	(i) stamens microsporangium & pollengrain microsporogenesis	* *	NCERT book fig 2.2. 2.3 , 2.5 p – 21 – 23	no. of cells in mature pollengrains
	(ii) pistil megasporangium (ovule) embryosac- megasporogenesis	* *	NCERT book fig 2.7(d) 2.8	no. of cells & nuclei in embryo sac , role of synergids
	2) pollination (i) autogamy , xenogamy, geitnogamy	* *	p – 24 – 27	self incompatibility
	(ii) agents of pollination	* * *		
	(iii) out breeding devices	***	NCERT book p – 27 – 28	
	(iv) pollen pistil interaction	*		
	3. Double fertilization			
	4. Post fertilization : structures & events – endosperm , embryo, seed	* *	NCERT book p – 31 – 33	triple fusion
	5. Apomixis - polyembryony		NCERT book p – 34 fig 2.12. (c,d,e) fig – 2.13, 2.14, 2.15 p – 35 NCERT p – 38 NCERT	free nuclear & cellular endosperm, embryo of monocot fail to differentiate apomixes , parthenocarpy

Definitions

- **DOUBLE FERTILIZATION** :- Fusion of one male gamete with egg and the other gamete with secondary nucleus (forming 3n endosperm nucleus)
- **FISSION** :- Fraction of nucleus with cytoplasm.
- **GOOTEE** :- bark of healthy and woody branch for grafting.
- **HELOBIAL** :- The mitosis is followed by cytokinesis forming two unequal cells. Subsequent divisions are free nuclear making the endosperm cellular after cytokinesis.
- **INCOMPATIBILITY** :- The inability of certain gametes, even from genetically similar plant species to fuse with each other. This is also called intraspecific incompatibility, self sterality.

- **NUCELLUS**:- The nucleus undergoes repeated divisions & nuclei so produced get arranged in the periphery leaving a large central vacuole-cytokinesis begins from the periphery towards the centre making it cellular at maturity. e.g. maize, wheat, sunflower.
- **PARTHENOCARPY** :- Development of fruit in an unfertilized flower resulting in a seedless fruit. e.g. grapes, banana, tomato.
- **REPRODUCTION** :- The process of producing offsprings and a means of self perpetuation.

DIFFERENCES

Geitonogamy	Autogamy
1. It refers to transfer of pollen grains from anther to stigmaof a different flower on the same plant 2. It requires a pollinating agent	1. It refers to transfer of pollen grains from anther to stigma of same flower on the same plant. 2. It does not requires a pollinating agent

Perisperm	Pericarp
1. It is the remnant of the nucellus left in the seed 2. It provides nutrition to the seed / developing embryo	1. It is the wall of fruit formed by the ovary wall. 2. It provide protection and help in dispersal of seed

Microsporogenesis	Megasporogenesis
1. It is the process of formation of microspore from microspore mother cell in anthers. 2. A no. of microspore pollen mother cell undergoes this process inside a microsporangium c) All the microspores formed from MMC are functional.	1. It is the process of formation of megaspore from megaspore mother cell in an ovule. 2. Only one of megaspore mother cell undergoes this process inside a mega sporangium. 3. Only one of the megaspores formed from MMC is functional

Geitonogamy	Xenogamy
1. It refers to transfer of pollen grains from anther to stigma of a different flower on the same plant. 2. It does not result in genetic variation	1. It refers to transfer of pollen grains from anther of one plant to stigma of another flower on the different plant 2. It result in genetic variation

True fruit	False fruit
1. They develop only from the ovary after fertilization. 2. eg. Mango tomato	1. Those fruits which develop from the parts of a flower other than ovary. 2. Apple , strawberry

ASSIGNMENTS:

LEVEL I

1. Name the protective substance present on the pollen envelope to tide over adverse conditions.
2. Your friend would like to cross-pollinate the bisexual flower. How can you guide him to be successful in his experiment?

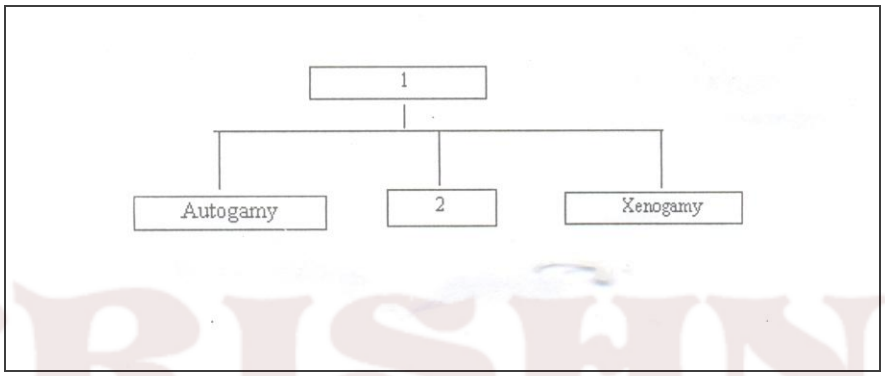
3 What is self–incompatibility? Mention two strategies evolved to prevent self pollination in flowers.

LEVEL 2

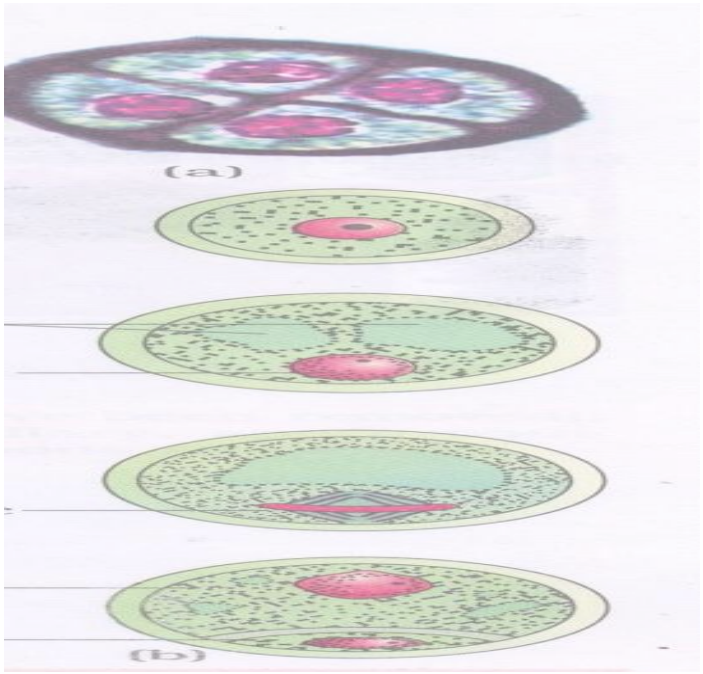
1 Why are pollen grains produced in enormous quantities in anemophilous flowers?

2 T.S. of anther shows four layers in the wall-epidermis, endothelium, tapetum and middle layer. Arrange them from outermost to innermost.

3. Complete the flow chart



4(i) What is the process shown in the diagram given below (ii) Name the structure at (a) of the figure



5. Both wind and water pollinated flowers are not very colourful and don't produce nector. What would be the reason for this?
6. (i) What are the pollen/nectar robbers?
(ii) Why do flowers pollinated by flies and beetles secrete foul odor?
7. What is pollen pistil interection? Why is it called a dynamic process?
8. Why do you think that the zygote is dormant for some time in a fertilized ovule?

LEVEL 3

1. Non-albuminous seeds do not have endosperm, then from where do they take the food during germination?

2 State the difference between the endosperm of gymnosperms and angiosperms.

3. If the number of chromosomes in the leaf cell of a flowering plant is 28, what number would you except in the embryo and endosperm of the plant?
4. Mention the scientific term used for modified form of reproduction in which the seeds are formed without fusion of gametes.
5. What will be the fate of ovule if the synergids are absent in the embryo sac?

6. (i)"The microspore is haploid while microspore mother cell is diploid" comment?
(ii) How many male gametes and female gametes are produced by –
a) 5 Microspore mother cells
b) 5 megaspore mother cells

7. Cleistogamy inspite of producing assured seed-set even in the absence of pollinators is considered disadvantages to the plant. Why?
8. What is the ploidy of the following?
(i) cells of nucellus, (ii) microspore mother cell, (iii) functional megaspore and (iv) female gametophyte?
9. How do the flowers of maize and cannabis pollinated? What are the features found in these flowers for such type of pollination?

10. How would you justify the absence of sporopollenin in exine of pollen grains at some places?
11.W hy does self pollination not lead to seed formation in self incompatible species?

12.(i) Generally nucellus does not persist in mature seeds. Cite two examples which show persistence of nucellus in the seed

SELF EVALUATION

1. Name the two wall layers of pollen grain and state the chemical nature.
- How many germ pores are there in pollengrain of monocots and dicots ? What is the function of germ pore?

2. Name the seed in which endosperm is present? How does the endosperm of gymnosperms differ from that of angiosperms?
3. Give the technical term and one example for each of the following :
    a) A plant in which separate male and female flowers are borne on the same individual at different positions
    b) A species in which the individual plant is either male or female
4. What are the different devices developed by plants to discourage self-pollination and encourage cross-pollination?
5. Show diagramatically the various events occuring in the development of female gametophyte in angiosperms.
6. Differentiate between geitnogamy and allogamy.

Chapter 3
Human Reproduction

Human Reproduction	1 male reproductive system (i) diagram & description (ii) parts of male reproductive system (structure) (iii) functions of parts of system (iv) accessory ducts (v) accessory glands	* * * * * * * * *	NCERT P – 43 , FIG 3.1 (B) NCERT P – 43-44 NCERT P – 43-44	Exact Location & Function Of Leydig Cells & Sertoli Cells
	2. Female reproductive system (i) diagram & description (ii) parts of female reproductive system (structure) (iii) functions of parts of system (iv) accessory ducts (v) uterus & its layers (vi) mammary glands	* * * * * * * * *	NCERT P – 44- 46 , FIG 3.3 (B) -DO- NCERT P – 44-46 NCERT P – 44 NCERT P – 46 NCERT P – 47	
	3 gametogenesis (i) spermatogenesis & diagram	** *	NCERT P – 47 FIG – 3.2 & 3.5 , 3.8 (a)	Exact Stage Where Meiosis I & Ii Occurs During Gametogenesis

	(ii) stages of spermatogenesis with names of cells & no of chromosomes (iii) structure of sperm (diagram) (iv) functons of each part of sperm & organelles (v) composition of semen	 *** *** *** **	P – 49 Page no 47 Fig 3.6, page no 48 page no 48 page no 48	As Well As The Ploidy Of Cells At Each Stage Of Gametogenesis
	4 oogenesis i)structure and description ii) development of follicles iii) stages with names of cells and no. of chromosomes with events iv) significance of polar bodies	 *** ** *** ***	Fig 3.7 ,Fig 3.8(b) Page no 48-49 Page no48-49 Page no48-49	Difficulty in relating different stages of oogenesis with different life stages.
	5 menstrual cycle (i) menarche and menopause (ii) phases of menstrual cycle with diagram (iii) role of hormones in cycle	 * ** ***	 Page no – 49, 51 Fig 3.9	Co-relation of levels of pituitary hormones and events during menstrual cycle
	6 fertilization and implantation (i) structure of ovum (ii) cleavage- formation of morula and blastula (iii)implantation- meaning, stage and site (iv) sex determination in humans (v) three germ layers	 * * * * * * * * * *	 Fig – 3.1, Page no – 51 Fig – 3.11 Page no – 52 Page 53 Page 52 Page 54	Labelling of mature graafian follicle
	7 pregnancy and embryonic development (i) placenta as endocrine	 * * *	 Page 53	

	gland (ii) embryo and extra-embryonic layers	* *	Fig – 3.12 Page 53	
	8 parturition (i) meaning (ii) foetal ejection reflex (iii) Role of hormones	* *	Page no – 54	Hormones involved at the time of parturition
	9 lactation Meaning, colostrum and its importance	*	Page no – 54	

DEFINITIONS:

- **CLOSOTRUM**:- the first milk that comes out of the mammary gland of the mother immediately after child birth is called colostrums.
- **FOLLICULAR ATRESIA**:- It is the process of degeneration of number of primary follicle in ovary of human female from birth to puberty.
- **GAMETOGENESIS** :- It refers to the process of formation of gametes for sexual reproduction.
- **GRAFFIAN** Follicle:- The mature follicle in the ovary is known as graffian follicle.
- **IMPLANTATION**:- The process in which embryo become embedded / attached to the wall of uterus is called implantation.
- **LECTATION**:- Due to the effect of hPL and progesterone after pregnancy there is starting of secretion of milk is called lactation.
- **L-H SURGE**:- it refers to maximum level of L-H during middle of menstrual cycle.
- **MENARCHE**:- The beginning of menstruation at puberty in primate females is called as menarche.
- **OOGENESIS**:- it is the formation of ova in the ovary by meiosis is known as oogenesis.
- **PRIMARY SEX ORGANS**:- The organs producing male and female gametes are known as primary sex organs.
- **SECONDARY** Sex Organs:- The sex organs which perform important functions in the reproduction but do not form gametes are called secondary sex organs.
- **SEMEN**:- The mixture of seminal plasma and spermatozoa is called semen.
- **SPERMIATION**:- It is the process of transformation of spermatids into spermatozoa is known as spermiation.

DIFFERENCES

Endometrium	Myometrium
1. It is innermost glandular layer that lines the uterine cavity. 2. Implantation occurs in this layer 3. It undergo cyclic changes during the menstrual cycle	1. It is the middle thick layer of smooth muscles of the uterine wall. 2. It is responsible for the uterine movement. 3. It does not undergo any cyclic changes during the menstrual cycle.

Spermatogenesis	Spermiogenesis.
1. It is the process of formation of mature spermatozoa in the testis 2.It involves meiotic and mitotic division 3. It is controlled by hormone LH and androgen.	1. It is a process of transformation of spermatids into spermatozoa. 2. It does not involve any division. 3. It is controlled by hormone LH only.

Blastula	Morulla
1. It is a hollow sphere of 32 or more cells formed by the rearrangement of blastomeres.	1. It is a solid sphere of 8- 16 cells blastomeres formed by cleavage of zygote.

2. Zona pellucida disintegrates with the enlargement of blastocoel.	2. Zona pellucida is intact.

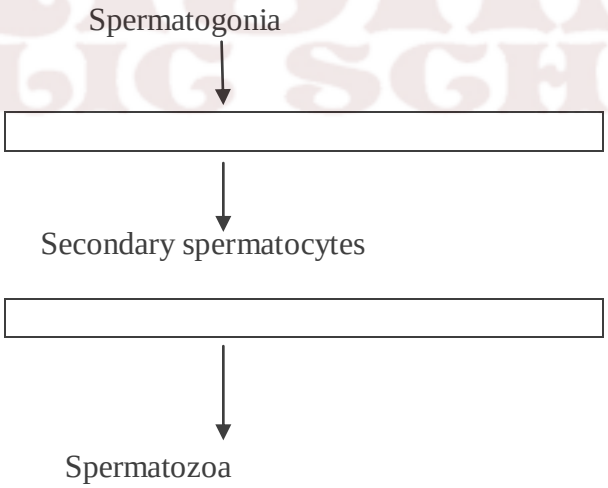
Menarche	Menopause
1. It refers to beginning of menstruation at puberty in primates/ human females. 2. It marks the beginning of reproductive phase	1. It refers to stoppage of menstruation at the age of 45-50 in primates/ human females. 2. It marks the end of reproductive phase

ASSIGNMENTS:

LEVEL 1

1.Why does failure of testes to descend into the scortum produce sterility?
2. Name the important mammary gland secretions that help developing resistance in the new born baby?
3. What are sertoli cells?
4. At what stage is the mammalian embryo implanted in the uterus?
5. What is spermiogenesis?
6. Name the ducts received by urethra in a human male?
7. At what stage is meiosis I suspended in primary oocyte?
8. When is meiosis II completed in the oogenesis of human female?
9. Define foetal ejection reflex?
10. Zygote undergoes mitosis to form 16 celled stage of embryo. What is it known as?

11. Fill in the boxes



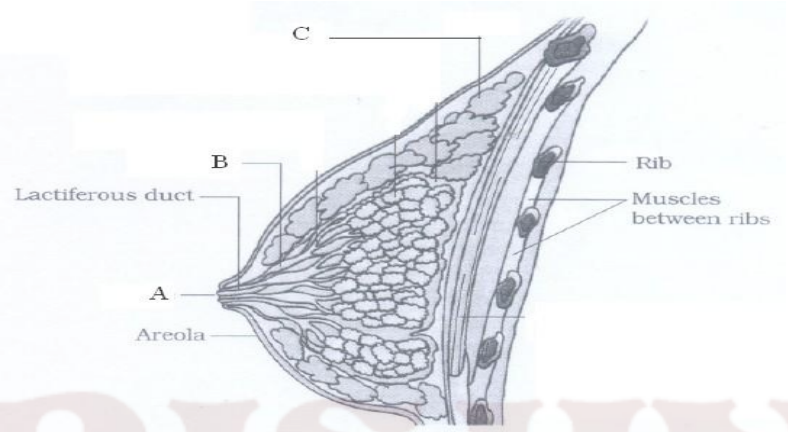
12. How do hormones secreted from anterior pituitary gland control and regulate the male reproductive system?
13. Why does fertilization takes place in fallopian tube and not in uterus?
14. Draw and label the main parts of the human spermatozoa. Why is the middle piece considered as power house of the human sperm?

LEVEL -2

15 What is acrosome? What is its significance?
16. Faillure of fertilization leads to menstruation. Explain.
17. What is the role of pituitary hormone in the regulation of menstrual cycle?
18. Mention the main changes taking place during implantation.

19. Name the hormonal secreted by placenta that play significant role in maintaining pregnancy?
20. State any two differences between Spermatogenesis and oogenesis.

21. During fertilization hundreds of sperm cells are in the vicinity of an egg cell. But only one sperm enters the ovum. How is this achieved?
22. What are the main events / changes taking place after implantation that lead to formation of Placenta?
23. Name the part of female reproductive system where the embryo is implanted. Mention the type of tissue by which it is made up of and give their functions?
24. Label a, b, c in the following diagram.



25. What is pregnancy hormone? Why it is so called? Name two sources of this hormone in a human female?

LEVEL-3

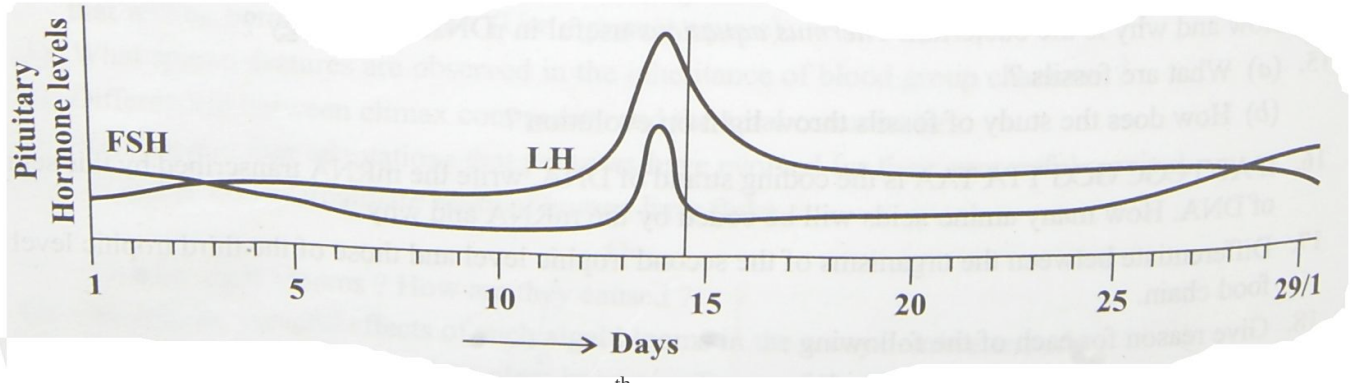
26. Give reasons:-
    i). zona pellucida layer block the entry of additional sperms?
    ii). sperm cannot reach ovum without seminal plasma?
    iii). all copulations do not lead to fertilization and pregnancy?
27. Furnish the technical term for the following:-
    i) the middle thick layer/wall of uterus
    ii) semen without sperm
    iii) mechanism responsible for parturition
28. Women are often blamed for giving birth to girl child in our society. What is your View?
29. What are following known as:-
    i) cushion of fatty tissue covered by skin and pubic hair in female external genitalia.
    ii) the finger like projections which collect ovum after ovulation
    iii) the finger like projections appearing in the trophoblast after implantation?
30. What is the fate of inner cell mass in the blastocyst? Mention their significance.

31. (i) What is the number of chromosomes in the following cells of human male?
    a. spermatogonial cells b. spermatids c. primary spermatocyte d. sertoli cells.
    (ii) How many sperms are present in an ejaculate of human male? What proportion of them should have normal size and shape and what proportion should have vigorous motility for normal fertility?
32. (A) Differentiate between menarche and menopause

(B) (a) Read the graph given below. Correct the ovarian events that take place in the human female according to the pituitary hormones during the following days:

(i) 10-14 days (ii) 14-15 days

(iii) 16-23 days (iv) 25-29 days (if the ovum is not fertilised)



(C) What are the uterine events that follow beyond 29th day if the ovum is not fertilised?

SELF EVALUATION

1. Name the important mammary gland secretions that help developing resistance in the new born baby?
2. Define foetal ejection reflex?
3. Faillure of fertilization leads to menstruation. Explain.
4. Draw and label the main parts of the human spermatozoa. Why is the middle piece considered as power house of the human sperm?
5. . Give reasons:-

i). zona pellucida layer block the entry of additional sperms?

ii). sperm cannot reach ovum without seminal plasma?

iii). all copulations do not lead to fertilization and pregnancy?

6. Women are often blamed for giving birth to girl child in our society. What is your View?
7. What is the fate of inner cell mass in the blastocyst? Mention their significance.

Chapter-4
:REPRODUCTIVE HEALTH

Reproductive Health	1. Reproductive health (i) Problems & Strategies 2. Methods of birth control 3. Infertility – Corrective treatments 4. Sexually transmitted	 ** *** ** ***	 Page 57-58 Page 59-61 Page 64 Page 63	 Amniocentesis Specific site for transplantation of embryo in GIFT and ZIFT

	diseases			
	5methods of birth control (i) natural methods (ii) barrier methods (iii)IUDS (iv)oral contraceptives (v) injections and implants (vi)surgical methods	**	Page66	

DEFINITIONS:

- **IN- VITRO FERTILIZATION** :- In- Vitro fertilization refersto thr fusion of gametes in the laboratory conditions.
- **INFERTILITY**:- The inability of couple/ person to produce new young one inspite of unprotective sexual act.
- **INTRA-UTERINE DEVICES**(IUDS):- These are the devices inserted in uterus to achieve contraception.
- **LACTATIONAL AMENORRHEA**:- It refers to the absence of menstruation during the period of intense lactation following parturition.
- **MEDICAL TERMINATION OF PREGNANCY**(MTP):- voluntary termination of pregnancy before full term is called MTP or induced abortion.
- **POPULATION EXPLOSION**:- An enormous increase in the size of the population in the short span of time is called population explosion.
- **REPRODUCTIVE HEALTH** :- It is total well being in physical, emotional, behavioural and social aspect of reproduction.
- **SEXUALLY TRANSMITTED DISEASES**(STDs):- Diseases or infections that are transmitted through sexual act are called STDs or reproductive track infections (RTIs).
- **TUBECTOMY**:- Sterilization process in female by cutting of fallopian tubes is called tubectomy.
- **VASECTOMY**:- Sterilization procedure in male by cutting and tying of vas deference is called vasectomy.

DIFFERENCES

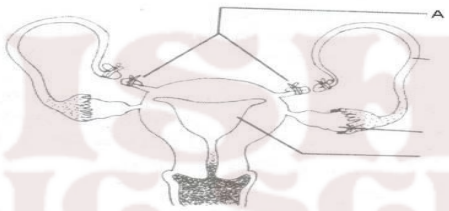
Tubectomy	Vasectomy
1. Method of sterilisaion in females 2. Fallopian tubes of both sides are cut and tied. 3. It prevents ova to reach the place of fertilization	1. Method of sterilization in males 2. Vas deference is cut and tied. 3. It prevents sperms to reach the place of fertilization.

GIFT	ICSI
1. called as gamete intra fallopian transfer(b).transfer of ovum from a donor female to provide suitable environment . 2. sperm is not directly injected to ovum 3. no artificial insemination is done	1. intra cytoplasmic sperm transfer this is a special technique to prepare embryo in lab . 2. The sperm is directly injected to ovum . 3. artificial insemination is done for infertile couple

ASSIGNMENTS:

LEVEL 1

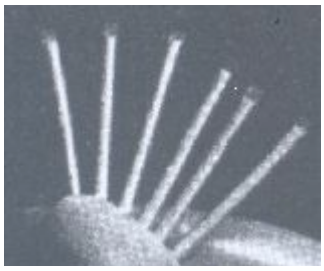
1. A large number of couples are said to be infertile. These couple could be assisted to have children through certain special techniques. Name one such technique.
2. Condoms are the barrier that prevents the ovum and sperms from coming closer. Suggest one more benefit of condoms
3. Differentiate between ZIFT and GIFT.
4. Give reasons why family planning techniques are not adopted by all in our country?
5. What are action plans/programmes initiated In India at the national level to attain total reproductive health?
6. Label the diagram and mark A in it.



3 Name a STD caused by protozoan.

4 How do Intra-Uterine devices (IUDs) prevent conception? List any two ways?

5 Identify the given diagram. What is it used for?



6 (i)Name the principle on which natural methods of Birth control work?

(ii) What is periodic abstinence?

7. Is sex education necessary in school if so, why? Give any four reasons.

8 Enumerate the complications that untreated STDs can lead to?

9 Mention the different ways in which people are made aware of the significance of reproductive and a reproductively healthy society?

LEVEL 3

1 At what stage zygote can be introduced in the fallopian tube in Zygote Intra Fallopian Transfer (Z.I.F.T.)

2 A doctor has observed the chromosomal disorder in developing foetus and advised the couple to undergo abortion. Suggest the technique by which doctor observed the chromosomal disorder.

3. A Women's husband is infertile. So the lady has decided to have baby by taking sperms from sperm bank. Which technique will you suggest for her pregnancy?

4. Following table gives certain terms associated with ARTS
Fill the spaces a, b, c and d.

Sr. no.	Column 1	Column 2
1	IVF and ET	a
2	b	Introduction of zygote or embryo with 8 blastomeres in fallopian tube
3	c	Introduction of Ova of a donor into fallopian tube
4.	IUT	d

5. 'Saheli' is an example of oral contraceptive-
(i)Name the non-steroidal principle in it.
(ii)How does it provide contraception.

6. During lactation chances of conception are almost zero.
(i) Give the reason.
(ii) Give the term used to describe the phenomenon?

SELF EVALUATION

1. What precautions a lady can take to prevent unwanted pregnancy?
   (i) Name the barrier.
   (ii) Mention the composition of it.

2. Mention any four possible ill-effects of contraceptives?
3. Give reasons why family planning techniques are not adopted by all in our country?
4. Mention any two probable reasons for repid rise of population in India from the time of independence to date.
5. What is the lactational amenorrhea method of birth control.
6. A mother of one year old daughter wants to space her second child. Her doctor suggested copperT. Explain its contra ceptive action.
7. Describe sexually transmitted diseases giving any two examples.

Chapter-5
Principles of Inheritance and Variations

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
5	Principles of inheritance and variations	1. Mendel's laws of inheritance			
		(i) Reasons for choosing garden pea	*	Page 11/7 of Pradeep's Textbook	
		(ii) Seven contrasting traits of pea plant	**	Fig 5.1 page 70—71	
		(iii) Symbols and terms used in mendel's experiment	**	Page 71-73	Gamete formation in dihybrid cross
		(iv) Steps involved in mendel's experiments	*	Page 70-71	
		(v) Monohybrid cross	***	Page 71-75	
		(vi) Test cross	***	Fig 5.5 74-75	
		(vii) Incomplete dominance	***	Fig 5.6 page	
		(viii) Codominance and multiple alleles	***	Table 5.3 page 77-78	
		(ix) Dihybrid cross	**		
		2. Chromosomal theory of inheritance	**	Fig 5.7 page 79	Heterogametey in sex determination
		3. Linkage and recombination	***	Table 5.3 fig 5.8-5.9	
		4. Sex determination in animals	**	Page 83-84	
		5. Mutations	**	Fig 5.12 page 85-86	
		6. Genetics disorder	***	Page 87	Use of symbols for autosomal and sex linked disorders
		(i) Pedigree analysis	***	Page 87-88 fig 5.13, 5.14	
		(ii) Mendelian disorders		Page 89-90	
		(iii) Chromosomal disorder		Page 90-91	

Definitions

- **ALLELES :**-Alternative forms of gene.

- **ANEUPLOIDY** :- The phenomenon of gain or loss of one or more chromosome.
- **AUTOSOMES** :- All the chromosomes of an individual that are not involved in the determination of sex.
- **BACK CROSS**:- When F1 progeny /heterozygous is crossed with either of the plant.
- **CO DOMINANCE** :- When two alleles of a gene are equally dominant & express themselves in the presence of other.
- **DIHYBRID** :- The individual that is heterozygous for the alleles controlling two characters.
- **DIHYBRID CROSS** :- A cross made between individuals of a species considering the inheritance of contrasting pair of two traits.
- **DOMINANT ALLELE :-** Allele that express itself in a hybrid/heterozygous condition.
- **EMASCULATION** :- Removal of anthers from the bisexual flower before maturation of pollen grains.
- **GENETICS :-**The branch of science that deals with inheritance & variations.
- **GENOTYPE :-**The genetic constitution of an organism.
- **HEREDITY ;-**The process of transmission of characters from one generation to another generation/parent to offspring.
- **HETROZYGOUS :-** Organism having dissimilar pair of allele for a character.
- **HOMOZYGOUS :-** Organism having similar pair of allele for a character.
- **INCOMPLETE DOMINANCE** :- When neither of two alleles of a gene is completely dominant over the other giving an intermediate character.
- **LINKAGE**:- The phenomenon where two or more linked genes are always inherited together/tendency of a gene (located on same chromosome) to move together into gametes.
- **LINKED GENES**-All the genes present on a chromosome.
- **MONOHYBRID** :- The individual that is heterozygous for the alleles controlling one character.
- **MONOHYBRID CROSS** :- Cross made between two individuals of a species considering the inheritance of the contrasting pair of a single character.
- **MONOSOMY** :- The condition where a particular chromosome is present in a single copy in a diploid cell.
- **MULTIPLE ALLELISM** :- When a gene exists in more than two allelic forms.
- **MUTATION** :- Sudden inheritable change in genetic material.
- **NON-DISJUNCTION** :- Phenomenon in which the members of homologous chromosome pair do not separate during meiosis.
- **OFFSPRING ;-**Products of sexual reproduction.
- **PEDIGREE ANALYSIS** :- It is an analysis of the distribution and movement of traits in a series of generations of a family.
- **PHENOTYPE :-** Observable or external characteristics of an organism.
- **PLEIOTROPY**:- When a gene has the ability to have more than one phenotypic effect.
- **RECESSIVE ALLELE** :- Allele that is not expressed in a hybrid/heterozygous condition.
- **RECOMBINANTS**-DNA formed by combining DNA from two different organisms.
- **RECOMBINATION** :- Exchange of gene segments between non-sisters chromatids of homologous chromosome pair.
- **SEX CHRMOSOME** :- Chromosomes that are involved in the determination of sex.
- **TEST CROSS** :- When F1 progeny is crossed with homozygous recessive parent.

- **TRISOMY** :- The condition where a particular chromosome is present in 3 copies in diploid cell.
- **VARIATION :-**Dissimilarities among the individuals of a species.

Differences

GENOTYPE	PHENOTYPE
1. Genotype remains the same throughout the life of an individual. 2. Genotype cannot be studied directly .it can be known through the study of ancestor, mating and offspring. 3. In a given environment or time, individual with similar genotype will produce similar character.	1. Phenotype may change with time and environment, e.g. infant. 2. Phenotype can be known through direct observation. 3. Individuals with similar phenotypes may not belong to same genotype.

DOMINANT	RECESSIVE
1. The condition in which the dominant allele is able to express itself even in the presence of its recessive allele is known as dominance. 2. In dominance, the dominant allele or factor can form complete polypeptide or enzyme for expressing its effects, e.g. red colour of flower in pea.	1. The condition in which recessive allele or factor is unable to express its effect in the presence of the dominant allele is known as recessive. 2. In recessive, the re4cessive allele forms an incomplete defective polypeptide or enzyme so that expressing consists of absence of the effect of dominant allele for e.g. white flower colour in pea.

INCOMPLETE DOMINANCE	CODOMINANCE
1. Effect of one of two alleles is more conspicuous. 2. It produces a fine mixture of the expression of two alleles. 3. The effect in hybrid is intermediate of the expression of the two allele.	1. Effect of both the allele is equally conspicuous. 2. There is no mixing of the effect of the two allele. 3. Both the allele produce their effect independently

Assignment Questions

LEVEL 1

1. Name the law that explains the expression of only one of the parental characters in the F1 generation of a monohybrid cross?
2.. What is a linkage map?
3.. How is the child affected if it has grown from the zygote formed by an XX–egg fertilised by a Y-carrying sperm? What do you call this abnormality?
4. Not all characters show true dominance. What are the two other possible type of dominance? Give an example of each?
5. What proportional of individuals produced in the progeny of a cross between two individuals with genotype TtSs will be TtSs and ttss respectively
6.. A cross between two plants heterozygous for a single locus was made. The progeny contained the following:
i) Round seeds, large starch grains: 1

ii) Round seeds, intermediate starch grains: 2
iii) Wrinkled seeds, small starch grains: 1
What phenomenon is exhibited by the above result? Show the genotype of the parents and offspring using a punnet square.
7. (i)In an experiment3:3:1:1 phenotypic ratio was obtained on crossing a pea plant with axial,violet flowers with another pea plant having axial, white flowers. Judge the accuracy of this result using a punnet square.
(ii) Two plants (Snapdragon) with red flowers and white flowers are crossed and produced all pink flowers in F1 generation
a) What phenomenon is responsible for it.
b) Write the genotype of F1.
c) Write the phenotype of F2 generation.
d) What would be the phenotype and genotype ratio of the F2 generation?

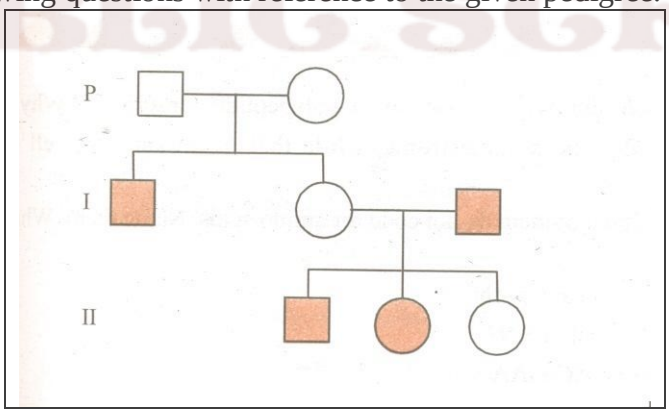
LEVEL 2

1. How many types of glycoproteins (oligosaccharides) that determine the ABO blood group are found on the surface of RBCs in humans?
2. Pick out the possible combinations of blood groups of parents of a boy who has a blood group O?
(i) Mother O group, Father AB group
(ii) Mother O group, Father heterozygous A group
(iii) Both Mother and Father A group (heterozygous)
(iv) Both Mother and Father AB group
3.. What was the most significant conclusion that Mendel drew from his experiment?
4.. A haemophilic man marries a normal homozygous woman. What is the probability that their daughter will be haemophilic? (a) 100%, (b) 75%, (c) 50%, (d) 0%.
5. A homozygous green seeded plant is crossed with yellow seeded plant. The progeny obtained was half yellow seeded and half green seeded.
i) Write the genotype of yellow seeded progeny.
ii) Write the technical name of cross.
6. A man with blood group O and his wife with blood group AB claim a child with blood group AB as their son. Justify whether it is possible or not with a punnet square.
7. (i) The egg of the animal contains 10 chromosomes of which one is X-chromosome. How many autosomes would be there in the karyotype of this animal?
(ii) What is meant by aneuploidy?
8.Write the sex chromosome complement of each of the following;
(i) Male fowl (ii) Human female (iii) Male grasshopper (iv) Female grasshopper
9. When two genes (involved) in a dihybrid cross are situated on the same chromosome, the proportion of parental gene combination was much higher than the non-parental combination. What is it due to? Who discovered the phenomenon?
10. (i) Which of the two, sperms or ovum, determines the sex of the offspring in fowl? Why?
(ii) What is the type of sex determination known as?
11. In Lathyrus, blue flower colour and long pollen are dominant over red flower colour and round pollen. In a cross between two plants, one with blue flowers and long pollen, both heterozygous and the other with red flowers and round pollen, the progeny contained the following:
Blue flowers, long pollen : 42%

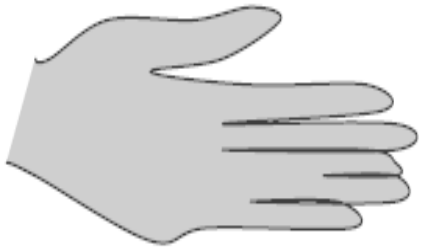
Blue flowers, round pollen : 08%
Red flowers, long pollen : 08%
Red flowers, round pollen : 42%
Explain the phenomenon responsible for such result?
12. Justify the situation that in human beings, sex of the child is determined by father, and not by mother?

LEVEL 3

1. What percentage of gametes produced by an individual with genotype AaBb will be ab?
2. Why does deletion or insertion of a segment of DNA result in alteration of chromosomes (also called chromosomal aberration)?
3. If the frequency of parental form is higher than 25% in a dihybrid test cross, what does that indicate about the two genes involved?
4. Dominance is not an autonomous feature of a gene or the product it codes for; it depends on the gene product and the production of a particular phenotype from the gene product. Justify with one example.
5. A colour blind man marries a woman with normal vision whose father was colour blind. Work out a cross to show the genotype of the new couple and their prospective sons?
6. Answer the following questions with reference to the given pedigree.



i) Is the trait autosomal dominant, autosomal recessive or sex-linked? Why? Justify your answer.
ii) Give the genotypes of the parents.
iii) Give the genotype of the daughter in the first generation and the son and the daughters in the second generations.
7. A male child was born with 47 chromosomes. Write any three possible combinations of chromosomal abnormalities and write one important symptom of each?
8 .Given below is a diagrammatic sketch of the hand of a person.



a) Name or mention the genetic feature.
b) Make a pedigree of the character to mention its inheritance? What do the circles and squares in the chart represent respectively?
c) Is it a sex linked character? Give reason in support of your answer.

Questions for Self Evaluation

1) The following table shows the genotypes for ABO blood grouping and their phenotypes . Fill in the gaps left in the table..

S.NO	Genotype	Blood Group
1	I^A I^A	A
2		A
3	I^B I^B	B
4		B
5	I^A I^B	
6		O

2) A homozygous green seeded plant is crossed with yellow seeded plant. The progeny obtained was half yellow seeded and half green seeded .
i) Write the genotype of yellow seeded progeny.
ii)Write the technical name of the cross.

3) Match the following with respective worker :

a. Transforming Principle	i) Messelson & Stahl
b. DNA is genetic material	ii) Watson & Crick
c. Semi conservative mode of DNA replication	iii) Fredrick Griffth
d. Proof of semi conservative replication	iv) Hershey & Chase

4) Assume that no new mutations have arisen in the family.
Answer each question with either 'Yes' or 'No'
i) Could this be inherited as recessive trait?
ii) Could this be inherited as dominant trait?

Chapter-6
Molecular Basis of Inheritance

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
6	Molecular basis of inheritance	1. DNA (i) structure and salient features	** 	 Page no. 96-98	 Polarity of two stands
		(ii) packaging of DNA helix	**	Fig 6.4 page 99	Histone and non histone chromosomal protein
		2. Search for genetic material (i) transforming principle (ii) Hershey and chase experiment (iii) properties of genetic material	*** *** ** ***	Page 100-101 Fig 6.5 Page 102 Page 103 Fig 6.7, 6.8 page 105-107	 Differentiation between transformation and transaction
		3. Replication – experimental proof	***		Leading and lagging strand direction
		4. Transcription (i) transcription unit (ii) Type of RNA and process of transcription	*** ** **	Fig 6.9, page 107-108 109-111 page 112	 Polycistronic, monoistronic, capping, taling
		5. Genetic code (ii)Mutations and Genetic Code	*** ****	Page 113 Fig. 6.12 Page-	 Frame Shift and Point mutation

		(iii) TRNA-The adapter Molecule		114	Charging of tRNA
		6. Translation	*	Fig. 6.13 Page	
		7. Regulation of Gene	****	115	
		Expression	***		Expresses Sequence
		(i) Levels of Regulation		Page 115	Tags Sequence Annotation
		(ii) The lac operon	****	Fig. 6.14,Page	BAC/YAC
		8. Human Genome Project		116,117 Page118-120	Satellite DNA,VNTR
		9. DNA Finger printing		Fi. 6.16 Page 121-122	

Definitions

- **ANTICODON** :- The sequence of nitrogenous bases on RNA that is complementary to the codon for particular amino acid.
- **BACTERIOPHAGE** :- A virus that infects a bacterium.
- **CODON** :- It is a sequence of three nitrogenous bases on m-RNA that code for a particular amino acid.
- **CONSTITUTIVE GENES** :- Constitutive genes are those genes which are constantly expressed & whose products are continuously needed for cellular activity.
- **DNA POLYMORPHORISM** :- Refers to the variations at genetic level where an inheritable mutation is observed in a population in a frequency greater than 0.01.
- **EXON** :- The regions of a gene which become part of m-RNA & code for the different regions of proteins.
- **FRAME SHIFT MUTATION** :- A type of mutation where addition or deletion of one or two bases changes the reading frame from the site of mutation, resulting in a protein with a different set of amino acids.
- **GENE** :- Segment of DNA that code for RNA/functional unit of heredity.
- **INTRONS** :- The regions of a gene which do not form part of m-RNA and are removed.
- **NUCLEOSOME** :- Structure formed when negatively charged DNA is wrapped around the positively charged histone octamer.
- **OPERON** :- All the genes controlling a metabolic process constitute an operon.
- **ORIGIN OF REPLICATION** :- It is the definite region of DNA where replication originates starts.
- **REPLICATION FORK** :- The Y- shaped structure formed when the double standard DNA is unwound up to a point during its replication.
- **SATELLITE DNA** :- The repetitive DNA sequences which do not code for any protein, but form a large portion of human genome; and show high degree of polymorphorism.
- **SILENT MUTATION** :- Mutation which do not cause any change in protein.
- **SPLICING** :- The process in eukaryotic genes by which the introns are removed are the exons are joined together to form m-RNA.
- **TRANSCRIPTION** :- It is the process of formation of RNA from DNA.

- **TRANSFORMATION** :- It is the phenomenon by which the DNA isolated from one type of cell, when introduced into another type is able to bestow some of the properties of the former to later.
- **TRANSLATION** :- It is the process of polymerization of amino acids to form a polypeptide dictated by mRNA.

Differences

DNA	RNA
1. It usually occurs inside nucleus and some cell organelles. 2. DNA is a genetic material. 3. It is a double stranded with the exception of some viruses (rabies, AIDS etc.) 4. DNA contains over a million nucleotides. 2. It contains deoxyribose sugar. 3. Nitrogen bases thymine occurs in DNA along with three others- adenine, cytosine and three guanine.	1. Very little RNA occurs inside nucleus. Most it is found in the cytoplasm. 2. RNA is not a genetic material except in certain viruses, e.g., Reovirus. 3. It is a single stranded with the exception of some viruses(e.g., double stranded in Reovirus) 4. Depending upon the type, RNA contains 70-12000 nucleotides. 5. It contains ribose sugar. 6. Thymine is replaced by uracil in RNA. The other are similar – adenine, cytosine and guanine.

PROCARYOTIC TRANSCRIPTION	EUKARYOTIC TRANSCRIPTION
1. It occurs in contact with cytoplasm. 2. Products of transcription become effective in situ. 3. There is only one RNA polymerase. 4. RNA polymerase does not have separate transcription factors. 5. mRNA is generally polycistronic. 6. Splicing is generally not required.	1. It occurs inside the cytoplasm. 2. Products of transcription come out of the nucleus for functioning in cytoplasm. 3. There are three types of RNA polymerase. 4. Transcription factors are involved in recognition of promoter site. 5. mRNA is generally monocistronic. 6. In most of the cases splicing required for removing intervening sequences.

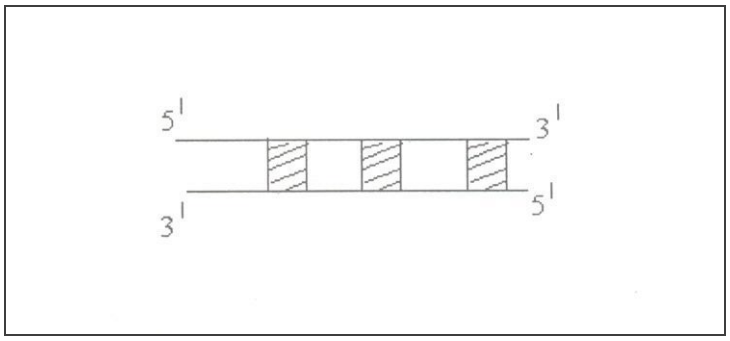
LEADING STRAND	LAGGING STRAND
1. It is a replicated strand of DNA which grows continuously without any gap. 2. It does not require DNA ligase for its growth. 3. The direction of growth of the leading strand is 5'→3' 4. Only a single RNA primer is required. 5. Its template opens in 3'→5' direction. 6. Formation of leading strand begins immediately at the beginning of replication.	1. Lagging strand is a replicated strand of DNA which is formed in short segment called discontinuous. 2. DNA ligase is required for joining Okazaki fragments. 3. The direction of growth of the lagging strand is 3'→5'though in each Okazaki fragment it is 5'→3'. 4. Starting of each Okazaki fragment requires a new RNA. 5. Its template opens in 5'→3' direction 6. Formation of lagging strand begins a bit later than that of leading strand.

TEMPLATE STRAND	CODING STRAND
1. The DNA strand that has the polarity 3'→5' acts as template during transcription is called as template strand. 2. It is also called as master strand or (-) or sense strand. 3. This takes part in transcription.	1. The strand which has polarity of 5'→3' is called as codon strand. 2. It is called (+) because genetic code present in this strand is similar to genetic code (based on mRNA) except that of uracil is replaced by thymine. 3. This does not take part in transcription.

Assignment Questions

LEVEL 1

1. The two strands of DNA have antiparallel polarity. What does it mean?
2. DNA fingerprinting is a technique to find out variations at DNA level among individuals of population. What is the principle on which it works?
3. What term is given to the flow of information from RNA to DNA in certain viruses?
4. A criminal case is 10 years old was registered for investigation. What samples they might have tested?
5. Pick out the untransalated regions from the given mRNA.
5' ACG UCG AUG GCG CCC UUU UAG GAG GAA 3'
Where are they normally located?
6. Illustrate below is a DNA segment which constitutes a gene.



i) Will the whole gene be transcribed in RNA primarily?
ii) Name the shaded & unshaded part to the gene,
iii) Explain how is gene expressed.
iv) How is the gene different from prokaryotic gene in its expression?

7. Which of the two –the coding strands or the template strands-will the RNA transcribed by the DNA, resembles? Why? How will they yet differ from each other?

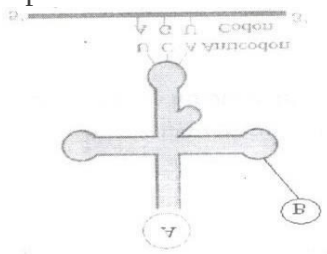
LEVEL 2

1. There are proteins which are positively charged and there are also negatively charged proteins. What makes the protein get its charge
2. What is ESTs?
3. A particular human gene has the largest number of bases. Identify it.
4. Why is mRNA of eukaryotic cells said to monocistronic, while that of prokaryotic cell is polycistronic?
5. A point mutation leads to adverse change in the function of hemoglobin (B-globin chain). Identify the disease that may occur due to this mutation. Mention the change of amino acids in the polypeptide due to mutation
6. Two persons filed a case against a lady claiming to be the father of her only daughter. How to find the real biological father
7. If a nucleosome contains 200bps, how many nucleosome are there in a mammalian cell? What changes occur to beads of strings of DNA during metaphase? 20. Given below schematic representation of two interacting bacterial cells.
8. Write the mRNA transcribed from the DNA segment with the base sequence TAC TAG TCG ACT. How many amino acids will there be in the oligopeptide translated by the mRNA? Why?
9. Lac operon is negatively regulated. What is meant by this? Why is lactose called the inducer of lac operon in *E.coli*?
10. (i) Describe the two major approaches to sequencing of genomes?
(ii) Expand SNPs. What are they?
(iii) Explain VNTR as the basis of DNA fingerprinting?
would be the phenotype and genotype ratio of the F2 generation.

LEVEL 3

1. The accessibility of promoter region of prokaryotic DNA is often regulated by the interaction of a protein with a certain sequence of DNA. What name is given to such a DNA sequence?
2. DNA is a polynucleotide characterized by two types of peaks. Which peak is known as satellite DNA?
3. Mention the role of DNA polymerase other than polymerizing deoxyribonucleotides during DNA synthesis.

4. DNA is unzipped twice in a cell. Mention the two events and the enzymes responsible for it.
5. i) Label the amino acids at A. write the name of RNA below
ii) Why is this molecule called an adapter molecule?



6. One student has drawn mRNA but he made some mistake in codons.
UGAU AGA UUU AUG

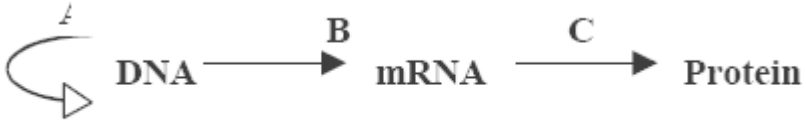
5’ |||| _ _ _ _ _ _ |||| 3’

i) Identify the mistakes made by him in codons.
ii) Correct the mistake?
7. A segment of DNA, TTC AGG GGG ATG was translated into an oligopeptide lysine-serine-proline-tyrosine.
(i) Write the codons for the four amino acids.
(ii) If the first adenine in the DNA segment is substituted by guanine, what will be the sequence of amino acids in the new oligopeptide?
(iii) Write the anticodons for these amino acids?
8. (i)Give two reasons why both the strands of DNA are not copied during transcription?
(ii) What are constitutive genes?

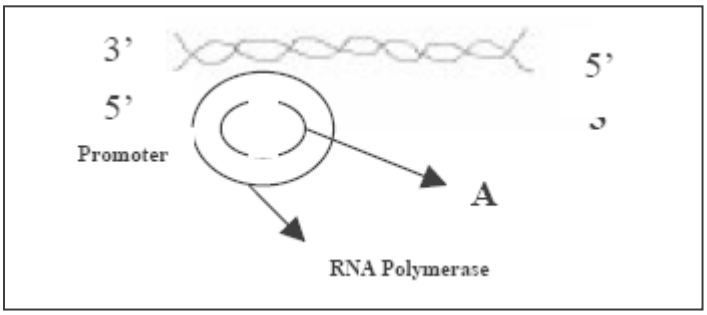
9. (i) A tRNA is charged with the amino acid phenylalanine.
(a) At what end of the tRNA is the amino acid attached?
(b) What is the mRNA codon that codes for phenyl alanine?
(c) Name the enzyme responsible for this attachment?
(d) Give the anticodon of this tRNA?
(ii) Explain the idea expressed in the following representation:
DNA=RNA=protein

Questions for Self Evaluation

1) Why the strand 5'-3' is called coding strand though it does not take part in transcription?
2) Complete the following, label A,B and C and name the process(Dogma).

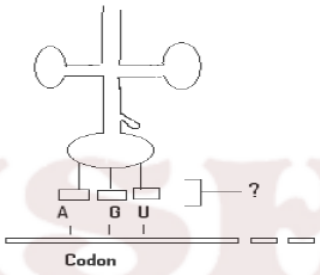


3) The diagram depicts a stage in transcription. Mention the stage and indicate A



4) Amino acid Arginine if coded by CGU; how many codons can code for this amino acid?

5) Write the anticodon of the given t-RNA



6) What is the difference between RNAs and RNase ?

Chapter-7
Evolution

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
7.	Evolution	1. Origin of Life 2. Evidences of Evolution 3. Adaptive Radiation 4. Biological Evolution 5. Mechanism of Evolution 6. Hardy-Weinburg Principle 7. A Brief Account of Evolution 8. Origin and Evolution of Man	* ** **** * ** *** * 	Fig 7.1 Fig. 7.3 Page 130-132 Fig. 7.5,7.6,7.7 Page 133 Page 134 Page 135 Fig. 7.8 Page 136-137 Fig. 7.9,7.10 Fig. 7.11 Page 140	 Branching Desent and Natural Selection Darwinism versus de-vries- -Saltation Hardy-Weinburg Equlibrium,Founder Effect

Definitions

- **ABIOGENSIS** :- The origin of life from non – living.
- **ADAPTIVE RADIATION** :- An evolutionary process in which a common stock / ancestor gives rise to new species that are adapted to new habitats and ways of life.
- **ALLOPATRIC SPECIATION** :- Origin of new species in geographically isolated populations.
- **ANALOGOUS ORGANS** :- Organs which are similar in appearance and perform similar functions but they are quite different in their origin and development.
- **ARTIFICIAL SELECTION** :- The process carried out by a select better breed of plants and animals, which are advantageous to human beings.
- **BIOGEOGRAPHICAL REALMS :-** Six major land masses on earth which are characterized by their own quota of life called flora and fauna.
- **BIOGEOGRAPHY** :- Study of patterns of distribution of plants and animals in different parts of the earth.
- **CONVERGENT EVOLUTION :-** Independent development of similar forms and features by unrelated organisms usually as an adaptation to a similar environment.
- **DIVERGENT EVOLUTION** :- Origin of a variety of species from a common ancestral form.
- **FOSSILS :-** The remains and / or impressions of organisms that lived in the remote part.
- **GENE POOL** :- The sum total of different kinds of genes (alleles) polled by all the members of a population, is called gene pool.
- **HOMOLOGOUS ORGANS** :- Organs in different groups of organisms, which have similar basic structural plan but superficially, look different and perform different functions.
- **NATURAL SELECTION :-** The process occurring in nature that acts over a number of generations and slowly increases the proportion of those individuals which are well adapted to the environment due to their heritable characteristics.
- **ONTOGENY** :- The stages of embryonic development of the organism.
- **ORIGIN OF LIFE :-** The appearance of life for the first time on the earth is called origin of life.
- **OUT BREEDING** :- Mating of two unrelated individuals.
- **PALAEOBOTANY** :- The study of fossil plants.
- **PALAEONTOLOGY :-** Study of fossils.
- **PALAEOZOOLOGY** :- The study of fossil animals.
- **PHYLOGENY** :- The evolutionary history of the organism.
- **SPECIATION :-** Origin of new species.
- **SPECIES** :- A taxonomic category including closely related, morphologically similar individuals which actually or potentially interbreed.
- **SYMPATRIC SPECIATION :-** Origin of new species in the populations occupying the same geographical area.
- **VESTIGIAL ORGANS :-** Organs that have no apparent function supposed to be remnants of organs once functional in the ancestors.

Differences

Homologous Organs	Analogous organs

1. They differ phenotypic ally. 2. They have similar internal structure. 3. They arise from similar position over the body. 4. Stages in the development are the similar. 5. They perform different functions. 6. They show adaptive radiation. 7. They occur in related organisms.	1. They show superficial resemblance. 2. Internal structure of analogous organs is quiet different. 3. They often arise from different positions over the body. 4. Stages in development are different. 5. They have similar functions. 6. Show convergent evolution. 7. Found in unrelated organisms.

Lamarkism	Darwinism
1. The theory believes in the presence of an internal vital force in all organisms. 2. It considers perfecting principle to be guiding principle for all organisms to achieve harmony with environment. 3. Modifications and even new organs can develop due to new needs, desires and conscious reaction. 4. Use and disuse of organs brings about their development and degeneration respectively. 5. Change in environment produces variations. 6. It does not consider any struggle for existence.	1. The theory does not believe in the presence of any internal vital force in all organisms. 2. Nature selects only those individuals which are adapted to the environment in which they live. 3. Modifications and development of new organs due to new needs, desires and conscious reaction do not form part of the theory. 4. An organ can develop further or degenerate only due to variations appearing in that direction. 5. Variations are already present. Changing

	environment selects some particular variations suitable for it. 6. Struggle for existence is very important ingredient of this theory.

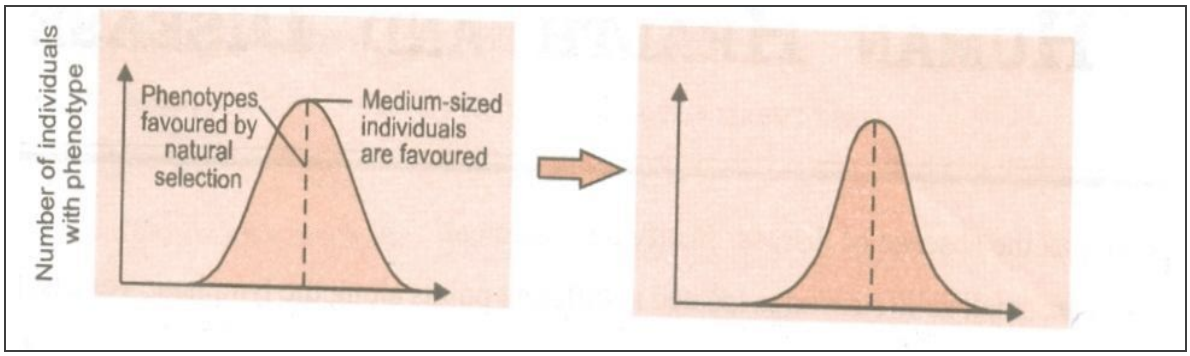
Assignment Questions

LEVEL 1

1. What is 'fitness' according to Darwin?
2. What is evolution according to Hardy-Weinberg?
3. What is common among the Australian marsupials like Koala, wombat, sugar glider etc.?
4. Can we call the human evolution as an example of adaptive radiation?
5. Why did the animals resembling horse, rabbit etc. of South America disappear, but the pouched mammals of Australia survived and flourished after continental drift.
6. Each of the placental mammals living in Australia resembles a similar marsupial. What is it due to? Give two examples of each
7. Name and explain the common evolutionary phenomenon shown by Australian marsupials and Darwin's finches

LEVEL 2

1. How does biochemistry provide evidence for organic evolution?
2. Give an example of evolution by anthropogenic activities?
3. Mention the two key concepts of Darwinism.
4. What is saltation
5. Name the group of extinct reptiles that was the ancestor of the present day reptiles and birds? Name the period of the geological time scale in which it lived?
6.



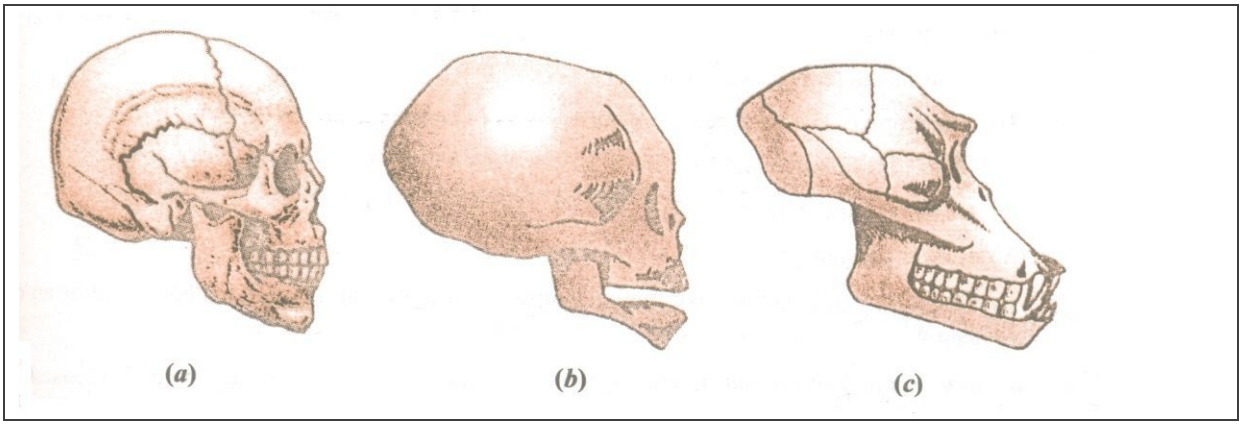
What type of selection is indicated? What happens in the process?
7. Hearts and brains of different classes of vertebrates are homologous or analogous? What do they indicate about evolution?
8. Explain how the atmosphere of Earth was formed?

9. Fill in the blanks with the names of the mammals of Australia

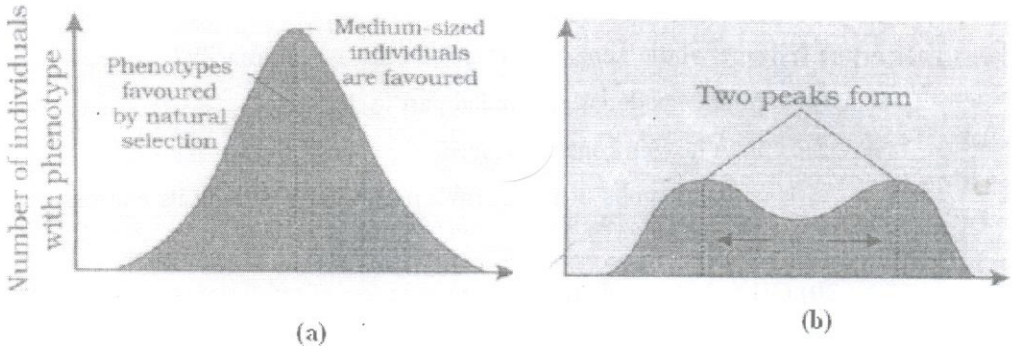
Placental mammals	Marsupial mammals
a	Numbat
Lemur	b
Bob Cat	c
d	Flying phalanger

LEVEL 3

1. What is genetic drift?
2. Identify the animal to which each of the following three skulls belong. Which two of them resemble more closely than the others?



3. Stanley Miller and Harold Urey performed an experiment by recreating in the laboratory the probable conditions of the atmosphere of the primitive earth.
i) what was the purpose of the experiment .
ii) in what form was the energy supplied for the chemical reactions to occur?
4. Why do we consider the lobefins have evolved into amphibians? Give reason.
5. Study the figures (a) and (b) given below and answer the question given after the graph



i) Under the influence of which type of natural selection would graph (a) becomes like graph (b)
ii) What could be the likely reasons of new variations arising in the population?
iii) Who suggested natural selection as a mechanism of evolution?
6. In England, after industrialization it was observed that white winged moth did not survive.
a) What you think the cause may be?
b) What was the change and why it has happened?
c) Which organism is known as natural indicator to air pollution?

Questions for Self Evaluation

1) Why do the animals have certain functionless organs in their body?
2) Which of the following are homologous organs?
a Trunk of an Elephant and forelimbs of a Monkey
b) Wings of a bird and wings of butterfly
3) Which of the following are analogous organs?
a) Legs of Cockroach and legs of Cat.
b) Pectoral fin of fish and forelimb of a frog.
4) Wing of bat is homologous to
a) Arm of a human
b) Tail of a kangaroo
c) Wing of a butterfly
5) Name the common ancestors of Apes and Man.
6) Give the Scientific name of first human like ancestors.
7) What causes speciation according to Hugo deVries?
8) Which were the first organisms that began to release oxygen as a byproduct of photosynthesis?
9) Name the extinct representative of modern man.
10) Consider a thorn in Bougainvillea and a tendril in cucurbita . Are these 2 organs homologous or analogous. Give reasons.

Chapter-8
Human Health & Diseases

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
8.	Human Health & Diseases	1.Common Diseases in human	**	Fig. 8.1 Page 146-149	
		2. Immunity			
		(i) Innate immunity	**		
		(ii) Aquired immunity	***		
		(iii) Active and Passive immunity			
		(iv) Vaccination and immunity		Page 150-154 NCERT	
		(v) Allergy		Fig. 8.4	
		(vi) Autoimmunity	*		
		(vii) Immune System of Body	** *		
		3. AIDS			
		4.CANCER	***	Fig 8.6 Text 156	
		5. Drug and alcohol abuse	*** ***	Text Page 156-158	
		(i) Adolescence and drugs		Text Page 158-163	

Definitions

- **CIRRHOSIS** :- A fatal disease of liver causes due to chronic use of alcohol.
- **CONTACT INHIBITION** :- A property of normal cells due to which contact with other cells inhibits their uncontrolled growth. Cancerous cells have lost the quality of contact inhibition hence divide uncontrollably.
- **DIEASE** :- A state when functioning of one or more organs or systems of the body is adversely affected, characterized by various symptoms, we say that we have a disease.
- **HEALTH** :- A state of complete physical, mental and social well being.
- **IMMUNITY** :- The overall ability of organisms to fight the disease causing pathogens, conferred by the immune system is called immunity.
- **VACCINE** :- Weakened pathogen or antigenic proteins of the pathogen introduced / injected into a healthy person to protect him from disease is called vaccine e.g. pulse polio.

Differences

Active Immunity	Passive Immunity
1. Antibodies are developed 2. By our own body cells in 3. Response to antigens. 4. It takes time to developed immunity. 5. It stays for longer period.	1. Antibodies are developed in other vertebrates in response to deliberate injection of antigens, are injected in our body. 2. It is used when immune response has to be faster. 2. It stays for short period.

Infectious Diseases	Non infectious Disease
1. They are transmitted from one person to other. 2. Caused by pathogens. 3. Typhoid , T.B., Flu etc	1. They are not transmitted from one person to other. 2. Caused due to habits deficiency, disfunctioning of organs etc. 3. Heart attack , cancer etc.

INNATE IMMUNITY	ACQUIRED IMUNITY
1. It includes all the defense elements with which an individual is born. 2. Non specific . 3. It consist of Physical , Physiological , Cellular and Cytokine barriers.	1. It acquired after birth either by contacting the disease or by vaccination. 2. Specific. 3. It includes hummreal or antibody mediated Immunity and cell mediated immunity.

Assignment Questions

LEVEL 1

1.It is advised to always complete the course of an anti biotic prescribed by the physician. Give the scientific reason?

2.Why is the antibody –mediated immunity called humoral immunity?

3.Why do children of metro cities of India suffer from allergies and asthma?

4.What is the role of following in body defence against infections?

(i) B-cells (ii) Histamine (iii) interferons

5.Some viruses can make DNA copy from RNA strand .Explain the mechanisms behind this processes

LEVEL 2

1A pathogen enters the small intestine through food and water contamination and migrates through blood, the sustained high fever weakness, stomach pain are symptoms. Which test confirms this disease.

2Once a person starts taking alcohol (or)drugs . how he may protect himself

3.Only female Anopheles mosquito acts as a vector? Why?

4. Name a plant other than coca plant that has hallucinogenic property?
5.A group of viruses infected only nose and the respiratory passages but not the lungs. Mention the disease and its causative organism.
6.Enumerate any two properties that distinguish the cancer cells from normal cells.
7.A person suddenly develops fever diarrhoea and weight loss. After test his blood was found low in lymphocytes.
(i) What could be the disease he is suffering from?
(ii) Name the confirmatory test to diagnose the disease.
(iii)Which particular part of the immune system is likely to get affected and in what manner?
8.Which chemicals are produced during allergic reactions? Also name the cells which produce these chemicals?

LEVEL 3

1.complete the table

S.NO	Effect on body	Name of drug	Source
1			poppy plant
2	sense of euphoria	cocaine	
3			*cannabis sativa*

2.A person need to take immune-suppressive agents all through his/her life after an organ transplant. Why?
3.Name the organism where antigenic polypeptide is produced by recombinant DNA technology
4.A person's nails and lips turn grey to bluish. Find out the disease he is suffering from. Name the pathogen.
5.Name the missing organisms/disease in the table below:-

Organism	Disease
Microsporum	A
B	Elephantiasis
C	Amoebiasis
Plasmodium falciporam	D

6.Lymph nodes are small solid structures located at different points along the lymphatic vessels. How are they involved in our immune system?
7. A person claimed that he has seen sounds, heard colours and smelt light.
(i) What could be the possible reasons?
(ii) Name two chemicals responsible for this condition.
Mention any one source for these chemicals.

Questions for Self Evaluation

Q 1 Name the type and give the effects of the following drugs on humans-
A) LSD B) Morphine C) Barbiturates.
Q2 What are the two chemical substances released into the blood by the mast cells ?
Specify the effect of each .
Q3 Why are some children diseases not appear for a second time ?
Q4 How does the skin serve as the first line of defence ?

Q5 A person was born without thymus gland but otherwise normal .Mention any four ways the person is likely to suffer due to its absence .

Chapter-9
Strategies for Enhancement in Food Production

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
9.	Strategies for Enhancement in food Production	1. Animal husbandry (i) Management of farm and farm Animal (ii) Animal Breeding (iii) Bee Keeping (iv) Fisheries 2. Plant breeding (i) Method (ii) For disease Resistance (iii) For Pest Resistance (iv) For Improved food quality 3. Single cell Protein 4. Tissue Culture	* ** ** * ** *** *** ** *** **	Page 165-170 Text Page 170-176 Text Portion Page176 Text Portion Page 177 Text Portion	

Definitions

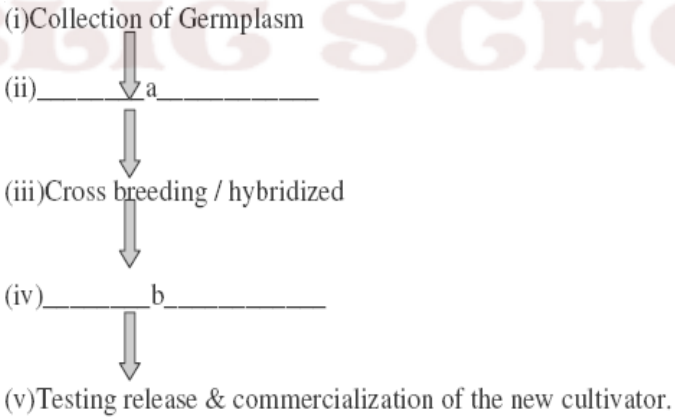
- **ANIMAL BREEDING** :- Mating or crossing of animals to improve the desirable qualities and yield or produce.
- **ANIMAL HUSBANDRY** :- The agricultural practice of breeding and raising livestock e.g. buffaloes, cows, pigs, horses, sheep, camel etc including poultry and fisheries.
- **APICULTURE** :- Bee keeping for production of honey.
- **BREED** :- A group of animals related by descent and similar in most characters, like appearance, features, size, configuration etc.
- **DAIRY FARM MANAGEMENT** :- The management of animals for milk and its products for human consumption.
- **FISHERIES** :- An industry devoted of rearing, catching, processing or selling of fish, shellfish or other aquatic animals.
- **GREEN REVOLUTION** :- Dramatic increase in food production in mid 1960s as a result of cultivation of high yielding disease resistant varieties of wheat, rice and maize etc developed through breeding techniques is referred to as green revolution.
- **MUTATION BREEDING** :- Obtaining crop plants with desirable characters by artificial or induced mutations and using them a material in breeding programmes is called mutation breeding.

- **PLANT BREEDING** :- The purposeful manipulation of plant species (Crop) to create desired plants best suited for cultivation, give better yields and are disease resistant.
- **SCP OR SINGLE CELL PROTEINS** :- Industrially or commercially produced edible proteins by culturing suitable micro organisms on large scale for nutrition for animals and human beings.
- **SOMACLONES** :- Genetically identical organisms or plants derived from single organisms through micro propagation are called somatic hybrid e.g. Tomato protoplast and potato protoplast.
- **TISSUE CULTURE** :- Growing whole plant from a part of plant such as leaf, root, pollen etc by growing these on an artificial nutrient medium under aseptic conditions is called tissue culture.
- **TOTIPOTENCY :-** The quality of isolated cells or tissue of an organism by virtue of which it can generate the whole of organism is called totipotency.

Assignment Questions

LEVEL 1

1.During a meristem culture some explants were kept in culture medium conrtaining more of auxins than cytokinins. Which organ of the plant is expected to differentiate from the callus?
2.Why hybrids of selected parents are self pollinated till a state of homozygosity?
3.To which product is blue revolution related?
4.Following are the steps in a particular process. Name the process and fill in the steps that are given as blanks.



5.Artificial insemination is a better approach than natural mating. Justify?

LEVEL 2

1.Clones are identical each other ?Is there any social implications of human cloning?
2.A technique by which cattle herd is increased in number in short period of time.name and describe it.
3. Why do we use apical and axillary meristems for tissue culture?
4. If your family owned a dairy farm, what measure would you undertake to improve the quality and quantity of milk production?
5. Biofortification can solve the problems of "hidden hunger" to a large extent. Prove it?

6. Insect/pest resistance in plants can be due to morphological, chemical or physiological features. Give one example each of the features and the species n which it is found?

LEVEL 3

1.What is reference material for comparison of any improved variety?
2.For which amino acid maize is biofortified?
3. Some time the disease resistance gene is present in the wild relative of crop plant. Give an example of crop plant where the resistance gene is present in its wild relative and name the wild relative
4.Two different plant of the same species, each with a different desirable trait are crossed to produce a hybrid that will have both the desirable character of the two parents. But, what are the drawbacks in the process of hybridisation of the selected parents?

Questions for Self Evaluation

Q1 What is interspecific hybridization ?
Q2 What should be done when inbreeding depression becomes a problem ?
Q3 Name any five hybreed varieties of crop plants which have been developed in India .
Q4 What are the commonly used growth regulators in plant tissue culture ? What for they are required ?
Q5 Define germplasm . How is it maintain ?

Chapter-10
Microbes in Human Welfare

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
10.	Microbes in Human Welfare	1. Role of Microbes in:- (i) House Hold (ii) Industrial Product (iii) Sewage Treatment (iv) Production of Bio Gas (v) As Biocontrol Agent (vi) As Biofertlizers	* *** ** * *** ***	Text Page 181 Page 182,183 Ex. Question 12 Page 184-185 Ex. Question 7,8,11 Page 185 Page 186-187 Page 188	

Definitions

- **BIOCHEMICAL OXYGEN DEMAND (BOD)** :- The amount of the oxygen that would be consumed if all the organic matter in 1 ltr. Of water were oxidized by bacteria.
- **BIOCONTROL** :- The use of biological method for controlling plant disease & pests.
- **BIOFERTILISER** :- The organisms that enrich the nutrient quality of the soil.
- **BIOGAS** :- The mixture of gases {mainly CH4, CO2} produced by the microbial activity & which can be used as fuel.
- **BT COTTON** :- A variety of cotton which is incorporated with Bt gene and it is resistant for insects & pests.

- **CLOT BUSTER** :- The microbial product for removing clots from the blood vessels of patients who have undergone myocardial infraction leading to heart attack.
- **FERMENTATION** :- The process of Anaerobic respiration in which complex molecules incompletely breaks into simple one by the microbial action.
- **FERMENTORS** :- The large containers made up of stainless steel require to grow microbes for industrial products.
- **METHANOGENS** :- The anaerobic bacteria which produce large amount of CH4, CO2 & H2 as they grow on cellulosic material.
- **MYCORRHIZA** :- A symbiotic association between fungal hyphal & roots of trees (Higher Plants)
- **PEST** :- Organism that destroys crop or its product is known as pest.
- **SEWAGE** :- The Municipal waste – water containing large amount of organic matter & microbes

Assignment Questions

LEVEL 1

1.Fungi associate with higher plant roots absorb phosphorus from the soil passes it to the plant. Mention the association between them

2. What is the key difference between primary and secondary sewage treatment?

3.How are the holes (spongy texture) produces in bread and cheese?

4.What is "Anaerobic Sludge digest"?

LEVEL 2

1.Do you think microbes can also be used as energy convertors? If yes how?

2. Single cell protein is one of the alternative source proteins for animal and human nutrition. Justify your answer.

3.Bottled juices are clearer compare to homemade juices. Give reason?

4. For the brain haemorrage of a patient, the doctor prescribed Streptokinase. Why? Mention the source of industrial production of this biomolecule.

5.What is cyclosporine A? Name the micro organism from which it is obtained. How it is used in human welfare?

6.. Why is organic farming favoured these days? Describe the method employed in the process.

LEVEL 3

1.Some Microbes are used to control other microbes , elaborate with examples

2. Why are most of the antibiotics sold in combination with lactobacillus, these days?

3. The Yamuna action plan and the Ganga action plan have been initiated to reduce BOD of these rivers in and around Delhi. What is understood by this statement?

4.Drinks like whisky and rum more intoxicating than wine. Why?

Questions for Self Evaluation

Q1 Which gas gives the puffed appearance to the dough ? Name the metabolic pathway taking place Resulting in the formation of this gas .

Q2 What is the key difference in the primary and secondary treatment ?

Q3 Describe the bio gas plant structure . Give various steps involved in obtaining biogas .

Q4 Why are chemical pesticides not preferred by the farmers in controlling pests ?

Q5 What is the advantage of "Legume –Rhizobium " symbiosis

Chapter-11
Biotechnology Principles and Processes

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
11.	Biotechnology principles and processes	1. Principles of biotechnology (i) techniques used in modern biotechnology (ii) advantages of sexual reproducton over a sexual reproduction (iii) genetic engineering includes reconibinant dna, genecloning a gene transfer (iv) meaning and use of plasmid restriction enzymen (v) basic steps for gmo 2. Tools of Recombinant DNA Technology 3. Cloning Vectors 4. Processes of Recombinant DNA Technology – Steps	* * * *** *** ***	NCERT text book xii fig . 1.2(a) (b) fig. 1.3, 1.4 page 5-8 NCERT book p – 15 - 19 ex q 2,6,9,13,15,18 Fig. 11.1-11.2-11.3 Page-195- 198 Fig. 11.4 Page-198-200 Fig. 11.6,11.7 Page 201-205	Fail to differentiate asexual reproductive structures- zoospores, conidium, gemules etc. Differentiation in monoecious & diocious

Definitions

- **BIOTECHNOLOGY** :- Technique of using living organism or enzymes from organism to produce product & processes useful to Humans.
- **CLONING** :- Producing exact copy or copies of a single parent.
- **DNA LIGASE** :- An enzyme that can seal one DNA fragment with another DNA segment, both having sticky ends.
- **ELUTION** :- The process top separate bands of DNA which are cut out from the Agarose gel & extracted from the gel piece.
- **ENDONUCLEASES** :- The enzymes which make cut at specific position within the DNA.
- **GEL ELECTROPHORESIS** :- The technique of separation of DNA fragments on a natural polymer(gel).
- **GENETIC ENGINEERING** :- The technique to after the chemistry of genetic material DNA / RNA to introduce these into host organisms & thus change the phenotype of the host organism.
- **GENOME** :- Total DNA in the cell of an organism.
- **LIGASE** :- An enzyme that joins the ends of two strands of Nucleic acid.

- **MICRO INJECTION** :- Introduction of foreign genes into animal or plant cell by injecting DNA directly.
- **PLASMID** :- Autonomously replicating circular extra chromosomal DNA of bacteria is known as plasmid.
- **TRANSFORMATION** : - It is a process through which a piece of DNA is introduced in a host.

Differences

Plasmid DNA	Chromosomal DNA
1. It is extra nuclear DNA 2. It carries non vital genes. 3. A bacterial cell may carry one to several plasmid DNAs	1. It is nuclear DNA 2. It possesses vital genes 3. A bacterial cell carries only one Chromosomal DNA

Exonucleases	Endonucleases
1. It breaks DNA from the ends. 2. The separated fragments are small nuceotides. 3. The separated fragments can not be used in genetic engineering.	1. It cuts DNA from inside. 2. The separated fragments are large nuceotides 3. The desirable separated fragments are used in genetic engineering.

Blunt Ends	Sticky Ends
1. Are cut in the centre of recognition sequence. 2. Are known as flush ends. Example: 5' C C C G G G 3' —*Sma* I→ 5' C C C 3'+5' G G G 3' 3' G G G C C C 5' 3' G G G5'+ 3'C C C 5'	1. Are short, single stranded end which can join single stranded ends of other DNA fragments having complementary sequences. 2. Are known as cohesive ends. Example: 5' G A A T T C 3' —*EcoRI*→ 5' G 3'+5' A A T T C 3' 3' C T T A A G 5' 3' C T T A A 5'+ 3' G 5'

YAC	BAC
1. Called Yeast Artificial Chromosomes. 2. Used to clone DNA fragments of more than 1 Mb in size. 3. Used in mapping large genomes e.g. human genome project 4. Insert size is 2500 – 1000.	1. Called Bacterial Artificial Chromosomes. 2. Used to clone 300-350 kb of foreign DNA. 3. Used in genome sequencing project. 4. Insert size is 50– 300.

Assignment Questions

LEVEL1

1.Which enzyme is called molecular scissors?
2.What do you mean by Ori?
3.Name the polymerase which is generally used in PCR reactions.
4.How is a host cell made competent in introducing rDNA?
5.Name the enzyme commonly used to dissolve the cell wall of bacterial cell?

LEVEL2

1.Why is a thermo stable DNA Polymerase needed in amplification/genetic engineering.
2.For the isolation of the genetic material , cells are treated with cellulose or chitinase . Give reason for it
3.Name the enzyme which cut the DNA molecules into fragments with sticky ends?
4.Which cloning vector was discovered first time?
5.Name the method in which foreign DNA is directly introduced into host cell?
6.Name a 'Natural genetic engineer' of plants?
7.What are the three basic steps involved in a single PCR amplification cycle.
8.Draw the diagram of PBR322 vector showing restrictions site
9.How is isolation of the genetic material done?
10.Give diagrammatic representation of rDNA technology

LEVEL3

1."Normal Polymerase can not be used in PCR.A particular polymerase is used in PCR."Name the source of that polymerase.
2. Each restriction enzyme cuts the DNA at a specific nucleotide sequence .Name such a sequence.
3.What type of cut ends are formed when both are fonned when both stands of DNA molecule is cleaved exactly at the same nucleotide position?
4.How does a transgenic organism differ from the rest of its population? Cite any two examples of such organism for human advantage
5.How is the gene z (for B-galactosidase) used as marker?
6.Besides better aeration and mixing properties what other advantages do stirred tank bioreactors have over shake flasks ?
7.How are bacteria made capable to take up recombinant DNA? Name the bacteria used for this process.
8.State the principle underlying 'gel electrphoresis' and mention two applications of this technique in Biotechnology.
9.DNA being hydrophilic cannot pass through the cell membrane of a cell. Explain how does recombination DNA get introduced into the cell to transform the latter.
10.In bacterial culture some of the colonies produce blue colour in the presence of a chromogenic substrate and some did not due to the presence or absence of an insert (rDNA) in the coding sequence of the beta- galactosidase.
a) Mention the mechanism and steps involved in the above experiments .
b) How is it better than the technique of plating on two plates having different antibiotics?

Questions for Self Evaluation

1 Differentiate between direct gene transfer and indirect gene transfer .
2 How is gene transfer in animals done ? Give the suitable example .
3 Name two recombinant proteins
4 Name atleast three therapeutically important products obtained through recombinant genetic engineering .

5 At what stage of meiosis a recombinant DNA made ?

Chapter-12

Biotechnology and its applications

Chapter No.	Chapter Name	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
12.	Biotechnology and its applications	1. Applications of Biotechnology in agriculture	* ** ***	Page 207-208 Page 208	
		(i) Advantages of GMO	***	Page 208-209 Page 209-210	Differentiation of Cry and cry
		(ii)Bt Cotton	***		nRNA silencing , nematode –
		(iii) RNA interference	***		
		2. Applications of Biotechnology in Medicines	* ** **	Page-210-211 Page 211	Meloidegyne incognitia Steps in production of insulin
		(i) Genetically engineered insulin.		Page-212	
		(ii) Gene Therapy- ADA		Page-213	
		(iii) Molecular Diagnosis of diseases.		Page-214	Role of Biotechnology in molecular diagnosis.
		3. Transgenic animals			
		4. Ethical issues , Biopiracy			

Definitions

- **BIO PATENT** :- A right given to inventor to get the economic benefits of the product. It also prevents the others to get benefit without permission.
- **BIOPIRACY** :- The use of bio resources by multinationals companies & other organizations with out proper authorization from the countries & people concerned without compensatory payment.
- **ELISA** :- It is a diagnostic technique based on the principle of antigen- antibody interaction.
- **GENE THERAPY** :- A collection of methods that allow correction of agene defect that has been diagnosed in a child / embryo.
- **GENETICALLY MODIFIED ORGANISM (GMO)**:- Plants, bacteria , fungi &animals(organisms) whose genes have been altered by manipulations are called G.M.O.
- **GREEN REVOLUTION** :- The process of increase in crop yields with the use of improved crop varieties, better management practices& use of agrochemicals.
- **PROBE** :- These are the detectable sequence of polynucleotide which are used to detect the presence of complimentary DNA sequence.
- **TRANSGENIC ANIMALS** :- Animals that had their DNA manipulated to possess & express an extra (Foreign) gene are known as transgenic animals.
- **TRANSPOSONS** :- these are the mobile genetic elements which replicate via an RNA intermediate.

Assignment Questions

LEVEL1

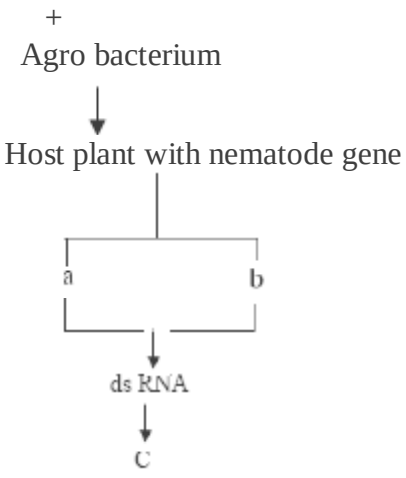
1. Excessive use of fertilizers and chemicals has harmful effects on environment. Suggest a possible solution to minimise this.
2.Which crops other than Bt cotton have been made pest resistance by genetic engineering?
3.Expand GEAC. What is its function?

LEVEL2

1.Some cotton plants grown by farmers are known as 'Bt cotton'.
a) What does Bt stand for?.
b)What is the advantage of this cotton plant?
c)How did scientists achieve this?
2.Name the vector which was used to introduce nematode specific gene into tobacco plant.
3.Transgenic cow Rosie was produced in 1997.
(a) Name the protein present in its milk.
(b) Advantage of protein enriched milk.
4.Dr.Arun developed a vitamin A rich potato through his research on genetics.
a)What do you call such potato plants?
b)Who can approve the validity and safety of introducing potato for public uses.

LEVEL3

1.How cryIAb differs from cryIIAb gene?
2. A method to present infestation of a nematode *Meloidegyne incognitia* on roots of tobacco is silencing the specific mRNA. What is the scientific name of the technique? How is this performed by ds-RNA?
3.A baby loses his mother in infancy .He was totally depended on breast feeding as cows milk creates digestive problems. Name the first cow whose milk is nutritionally more balanced than normal cow's milk. Which extra nutritional element does it contain and how much magnitude?
4. Shahid a two years old baby is deficient in his immune system since birth. His father was told that this was due to an enzyme deficiency which is crucial for the immune system to function. Name the enzyme, the cause of its deficiency and the cure of the disease?
5.Nematode specific genes.



i) What is this technique of pest control called?ii) Specify a, b & c in the chart given.

Questions for Self Evaluation

1. A four years old girl suffered from ADA deficiency. She was cured by inserting a correct gene into her.a) what is this process called? b) In which cells are the genes introduced ?
2. What is the other name of mobile genetic elements?
3. Differentiate between insulin and pro insulin?
4. Explain down stream processes?
5. Differentiate exonuclease and endonuclease.
6. Expand the term PCR.
7. What is its importance in genetic engineering?

CHAPTER 13

Organisms and Populations

S.NO	CHAPTER	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
13.	Organisms and Populations	1. Organisms and its Environment			
		(i) Major Abiotic Factors	**		
		(ii) Responses to Abiotic Factors	**	Page -221-223 NCERT	Eurythermal &
		(iii) Adaptations	***	Fig. 13.3 Page 223-225	stenothermal
		4. Populations:-	***	Page 225-226	Conformers, Regulators
		(v) Population Attributes	***		
		(vi) Population Growth	*		
		(vii) Life History variation	**	Fig. 13.4 Page 226-228	
		(viii) Population interactions		Fig. 13.5 Page 228-231 Page 231-232 Table 13.1 Page 232-238	Distinction between Expanding, stable, declining population. Distinction between Exponential and Logistic growth curve. Distinction between commensalisms and Amaensalism.

DEFINITIONS

- **AMENSALISM** :- Interaction in which one species is harmed whereas the other one is unaffected.
- **CARRYING CAPACITY** :- Maximum size of population that can be sustained by the environment.

- **COMMENSALISM** :- Interaction in which one species gets benefits and other is neither harmed nor benefited.
- **CONFORMERS** :- Majority of animals and nearly all plants which cannot maintain constant internal environment.
- **EURYTHERMAL** :- the organisms that can tolerate and thrive in a wider range of temperature.
- **EXPONENTIAL GROWTH** :- Unimpeded growth of a population in an environment with abundant resources.
- **LOGISTIC GROWTH** :- Growth of a population in an environment with limited resources (initial lag phase, phase of acceleration and finally stationary phase).
- **MORTALITY** :- The number of deaths in a population during a given period.
- **NATAILITY** :- The number of births in a population during a given period.
- **POPULATION DENSITY** :-The number of individuals of a species present in per unit area at given time.
- **REGULATORS** :- The organisms which maintain homeostasis (constant body temperature and osmotic concentration) by physiological means.
- **STENOTHERMAL** :- The organisms that area restricted to narrow range of temperature.

ASSIGNMENTS

LEVEL 1

1 Why is thermoregulation more effectively achieved in larger animals than smaller ones?
2 What are osmoconformers?
3.What are the 2 forms of population growth?
4.What type of interaction is shown by sparrow eating the seeds?
5.How are eurythermal animals differ from stenothermal?
6.Name the four levels of organization that are studied in ecology.
7.Give any one example of brood parasitism.
8.Write an expression, which gives the change in population size after a given time.

LEVEL2

1.Mention the adaptations the mammals of colder areas have.
2.When does a population growth curve assume J-shape?
3.What is Gause's Compitition Exclusion Principle? Give 1 example.
4. How is cactus adapted to survive?
5. Lichen and mycorrhiza are very important examples of mutualism.
   (i) Define mutualism.
   (ii) Write the names of components of both.
   (iii) What is the benefit of mutualism to both of them.
6. What type of morphological and physiological defences have been evolved by plants.

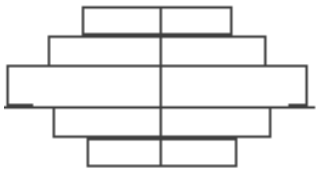
LEVEL3

1. Mr. Ram on a trip to Rohtang Pass Suddenly experienced heart Palpitations, Nausea, fatigue etc on reaching the destination. Suggest the reasons for his sudden deterioration of health and also state whether his body will withstand this problem if he stays there for long and how?

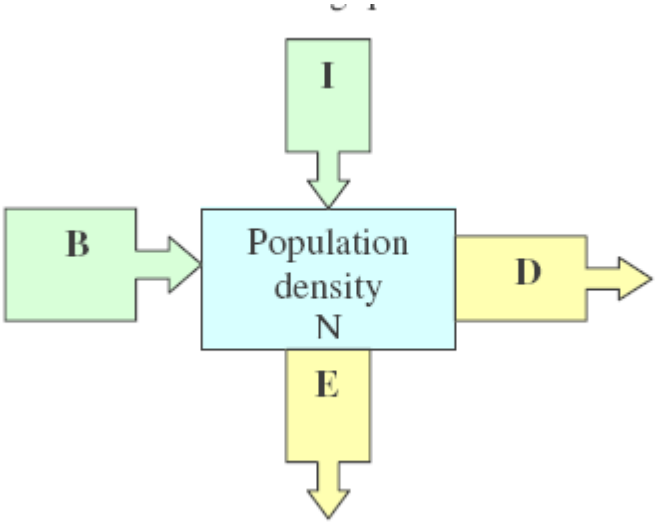
2. Observe the following equation :

$$\frac{dN}{dt} = rN\left[\frac{K-N}{K}\right]$$

i) Name the population growth curve.
ii) What does N, r and K represent?
iii). What type of growth status the following pyramid represents.



3. .Anand on a visit through an under the ocean aquarium found that many sea anemones are attached to hermit crab shells, sucker fisher attached to the ventral surface of sharks and clown fish living among the sea anemones. He wondered whether all these associations are of the same type; can you help him to arrive at the correct conclusion.
4. Abingdon tortoise in Galapagos Island became extinct with in a decade after goats were introduced on the island. Why? What could be principle behind this situation?
5. An orchid plant is growing on the branch of a mango tree. How do we describe this interaction b/w orchid and mango tree?
6. Observe this diagram and answer the following question



a. What is the terminology for B& E.?

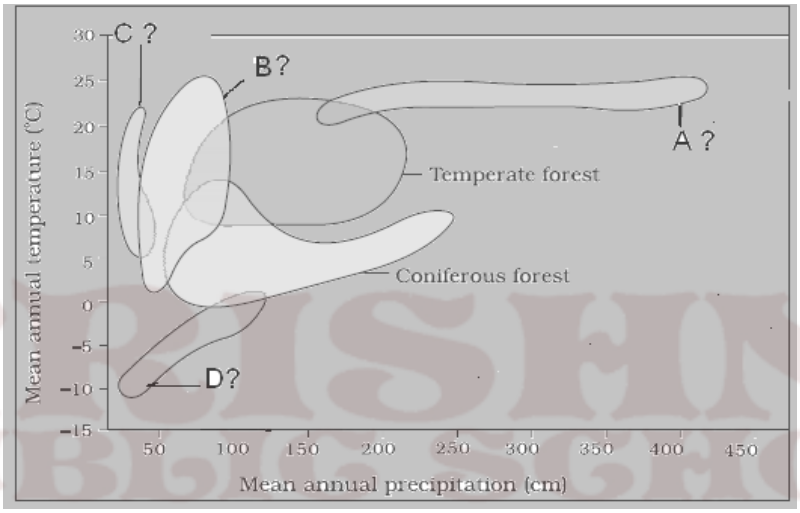
b. If B + I is more then D + E then what will happen to population density.

(c) What are the most important factors which influence a population density of an area under normal condition ?

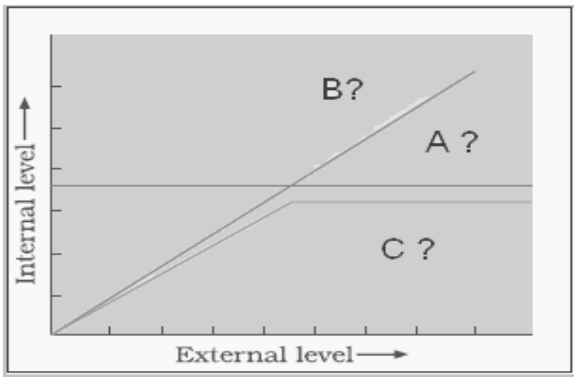
(d) If a habitat is being colonised recently then which factor contribute more to the population growth

QUESTIONS FOR SELF EVALUATION

1. An orchid plant is growing on the branch of a mango tree. How do we describe this interaction between orchid and mango tree?
2. The population of tigers in a forest becomes zero, due to uncontrolled hunting. What would be the long term effects of this situation in the forest?
3. Identify the biome distribution with respect to annual temperature and Precipitation from the following graph. Answer A, B, C & D.

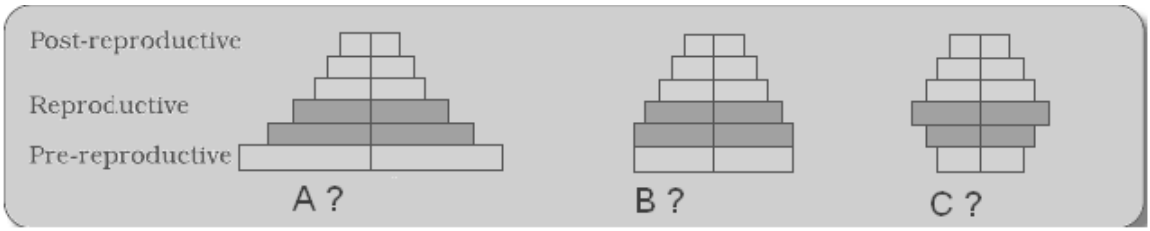


4. The following graph represents the organismic0 response to certain environmental condition.
   (i) which one of these, A , B , C depicts conformers?
   (ii) How do A , B differ from each other with reference to homeostasis?
   (iii) What does C of graph depict?
   (iv) Mention the category to which man belongs.



(i) Men Study the given age profiles related to human population and answer the following questions.

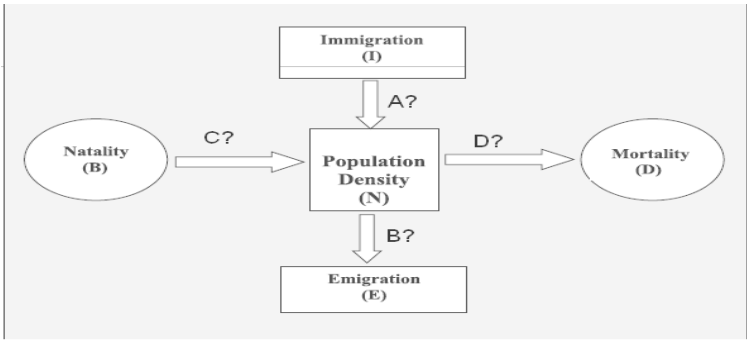
(ii) tion the names given to A , B , C kinds of age profiles.
(iii) Which one of these is ideal for a population?
(iv) How do such age profile studies help policy makers prepare for future planning?



5. Why small animals are rarely found in polar region?
6. How does the special photosynthetic pathway like CAM support desert plants?
7. Why do animals migrate from one region to the other region in the cold season?
8. What type of population interaction in A, B, C, D between the species A and B as per the tabular column given below.

Species A	Species B	Name of Interaction
+	+	A?
+	–	B?
+	–	C?
–	0	D?

Which of the following A, B, C and D represent increase and decrease in population growth?



Chapter-14 Ecosystem

S.NO	CHAPTER	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
14.	Ecosystem	8. Structure and function 9. Productivity 10. Decomposition 11. Energy Flow 12. Ecological Pyramids 13. Ecological succession 14. Nutrient cycling	* ** ** * *	Page 242 Ex Q. 9 Fig. 14.1 Page 243-244 Ex. Q10 Page 245,247 Ex. Q. 11 Fig. 14.4 Page 248 Fig. 14.5 Page 250-251 Fig. 14.6 Page 253-255 Ex. Q. 12,13	GPP,NPP

- **BIOGEOCHEMICAL CYCLE** :- The movement of nutrient elements through various components of an ecosystem(between living organisms, soil, air and water).
- **BIOMASS** :- The amount of organic matter present in an organism/ a trophic level / an ecosystem.
- **DETRITIVORES** :- Organisms which feed on the detritus and break it down into smaller particles.
- **DETRITUS** :- Dead remains of plants and animals or their wastes.
- **ECOLOGICAL PYRAMIDS** :- Representation of trophic structure (Number, Biomass . or Energy at various trophic levels) of a food chain.
- **ECOLOGICAL SUCCESSION** :- Phenomenon in which structure and composition of a community changes in an orderly and sequential manner leading to the climax community.
- **ECOSYSTEM: -** Functional unit of nature where living organism interact among themselves and also with physical environment.
- **ECOSYSTEM SERVICES**: - The products of ecosystems processes are termed as ecosystem services.
- **FOOD WEB: -** A network formed by interconnected the food chain.

- **HUMIFICATION: -** Process of changing Detritus into a dark coloured amorphous matter called humus.
- **HYDRARCH: -** Ecological succession in water bodies like lakes resulting in climax community.
- **MINERALISATION** :- Process of Degradation of Humus by some microbes into
- Inorganic nutrients.
- **PIONEER SPECIES:**-The species which invade a bare area and initiate the ecological succession.
- **PRIMARY PRODUCTIVITY: -** Amount of biomass or organic matter produced per unit area over a time period by the plants.
- **PRIMARY SUCCESSSION: -** Ecological succession on previously sterile area such as bare rocks or lake forming climax community.
- **PRODUCTIVITY:**-Rate of production of biomass.
- **SECONDARY PRODUCTIVITY**:- The rate of assimilation and formation of new organic matter by consumer.
- **SECONDARY SUCCESSION: -** Ecological succession in an area where previously established community is destroyed due to fire or floods etc.
- **SERE** :- The sequence in which one community is replaced in an area by another resulting in a climax community.
- **STANDING CROP** :- The amount of living matter(biomass) present at a trophic level.
- **STANDING STATE** :- The amount of nutrients present in the soil at any given time.
- **STRATIFICATION** :-Vertical distribution of different species occupying different levels in an ecosystems.
- **TROPHIC LEVEL** :- Every step or link of a food chain.
- **XERARCH** :- Ecological succession on bare rocks or sand resulting in climax climax community.

ASSIGNMENTS

LEVEL1:-

Q1) What is biomass ?

Q2) Name the four important functional aspects of ecosystem

Q3) Name the two forms of reservoir of carbon that regulate the ecosystem carbon cycle .

Q4) Name the dominant producers in a deep aquatic ecosystem .

Q5) What is NPP?

Q6. What are the two basic catagories of ecosystem? Give example

Q7.What is food chain? Give an example.

Q8. Describe the major components of ecosystem

LEVEL 2

Q1) What do you mean by transducers ?

Q2) What is meant by productivity of a trophic level ?

Q3) Which species is the pioneer species on a bare rock

Q4.What are decomposers? Write their function.

Q5.What is the difference between gaseous and sedimentary cycle?
Q6.Mention two factors by which productivity is limited in an aquatic ecosystem.

Q7.Expand PAR, How much PAR is used in gross primary productivity?
Q8.Give account of factors affecting the rate of decomposition.
Q9) What are ecological pyramids ? Mention its limitations .
Q11. Give an account of energy flow in an ecosystem.

LEVEL 3

Q1) Why the pyramid of energy is always upright ?

Q2) What is bioenergetics ?

Q3.Why is the length of a food chain in an ecosystem generally limited to 3-4 trophic levels?
Q4.What are the differences between detritus and grazing food chains?
Q5.Briefly describe the process of decomposition
Q6 .Describe pond as an ecosystem .

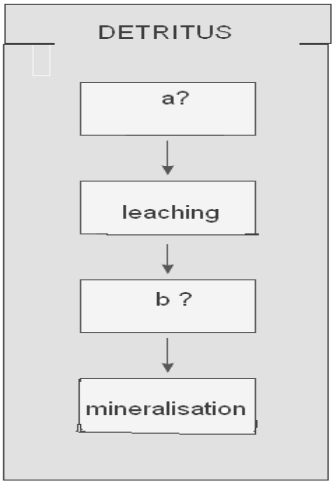
Q7.What is xerosere? Describe the process of succession on a bare rock

QUESTIONS FOR SELF EVALUATION

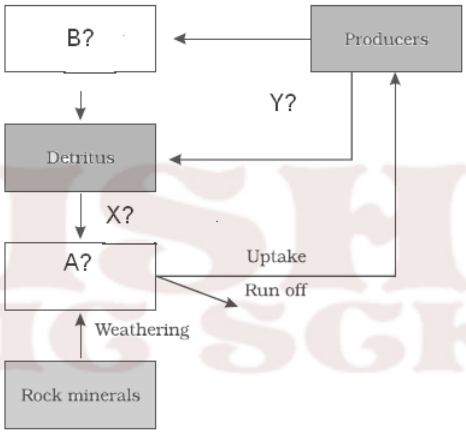
1. Which ecosystem has maximum stratification?
2. What is the approximate value of Net Primary Productivity of the biosphere?
3. Find out the consumer of top order/ top carnivore from the following food chains.
   a) Phytoplankton - small fishes - large fishes - Hawk

4. Based on the following information, answer the A, B, C and D with reference to Grass land ecosystem

5. . Longer food chains are not viable in the ecosystem from the energy point of view. Why?
6. Why food chains in the environment are operative in the form of food web?
7. i) Complete the steps of decomposition process by using a suitable terminology in a & b.
   (ii) List the factors which affect decomposition process.



8. Complete the following simplified schematic diagram of Phosphorous cycle by writing the correct answer for ‘A’, ‘B’, ‘X’ and ‘Y’.



9. Why are all the pyramids upright in most of the ecosystems?
10. Primary productivity of tropical rain forest is highest among terrestrial ecosystems while that of desert is lowest. Which factors are responsible for this difference?

Chapter-15 Biodiversity And Conservation

S.NO	CHAPTER	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
15.	Biodiversity and Conservation	5. Patterns of Biodiversity 6. Importance of species diversity to ecosystem. 7. Loss of Biodiversity 8. Conservation of Biodiversity	*** * *** ***	Fig. 15.1 Text page 259 Ex. Q 3 Page 263 Page 264-265 Ex. Q. 5 Page 265-267 Ex. Q. 7	Graphical representation , species area relationships Crypreservation

- **BIODIVERSITY** :- It is the term used to describe the combine diversity at all the levels of biological organization.
- **ECOLOGICAL DIVERSITY** :- The diversity at the ecosystem level .
- **ENDEMISM** :- It is the condition when species confined to that region and not found anywhere else.
- **GENETIC DIVERSITY** :- The High diversity shown by a single species at the genetic level(distributional level .)
- **SPECIES AREA RELATIONSHIPS** :- The relation between species richness and area.

DIFFERENCES

Alpha Diversity	Beta Diversity
1. It refers to the diversity of the organism sharing the same habitat or community. 2. It is within community diversity.	1. It refers to the diversity of the organism in different communities in a habitat. 2. It is between community diversity.

Ex-situ Conservation	In-situ conservation
1.It is called off-site conservation. 2.Includes botanical garden, zoos, gene bank, seedlings etc.	1.It is called on-site conservation. 2.It includes wildlife sanctuaries, national parks, as well as pro0tected areas to protect endangered species in natural habitats.

ASSIGNMENTS
LEVEL1

1. What is the approximate no of plant and animal species described so far by IUCN (2004) report?
2. Which type of graph curve is obtained when species richness is plotted against area?
3. Name a few weeds that have invaded our crop fields as alien species. Why these have become uncontrollable
4. Categorize the following into in-situ and ex-situ approaches of biodiversity conservation.

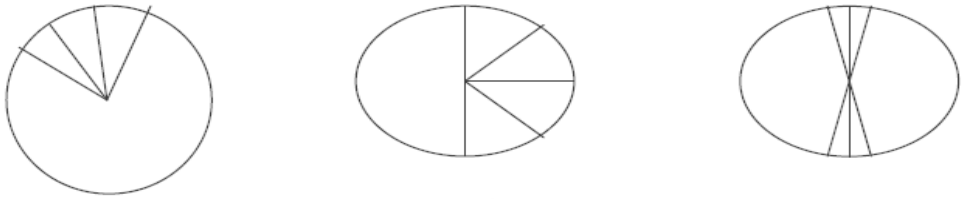
   i) Botanical gardens ii) Wild life sanctuaries iii) Gene bank
   iv) Biosphere reserves v) Sacred forests/lakes vi) Pollen banks
   vii) Tissue culture viii) Cryo-preservation

LEVEL2

1. Reserpine is obtained from a plant found in Himalayan ranges. Name the plant.
2. Western Ghats have greater amphibian species diversity than Eastern Ghats. Why?
3. Who proposed rivet popper hypothesis? Describe this hypothesis briefly.
4. Which type of organism are prone to co extinction and why?

LEVEL3

1. What do you mean by bioprospecting?
2. What is depicted by the following representation of species diversity? Why these estimates do not give any figure-for prokaryotes.



3. The invasion of alien species is responsible for extinction of the indigenous species. Give 2 examples to support this statement.
4. If a speices of fish becomes extinct, all those parasites, specific to that fish also face extinction. Which of the major cause describe as “the evil Quartet’s is being accounted?

5. Categorize the followings statement into narrowly utilitarian, broadly utilitarian and ethical reason:-

i) Every species in biodiversity has an intrinsic value even if it not of value to us.

ii) Human beings device a number of economic benefits like food, fiber etc from biodiversity.

iii) Biodiversity provides ecosystem services which can not be given price tag. Justify your categorization also.

6. Since the origin of life on earth and evolution there have been 5 episodes of mass extinction, but the current rate of extinction is 100-1000 times. What are the main causes of high extinction rate and how is it going to harm human beings

QUESTIONS FOR SELF EVALUATION

1 What is IUCN Red list ? Give any two uses of this list .
2Name any 2 threatened animal species of India .
3Which are the biodiversity HOT Spots in India ?
4Name two alien species introduced in India .
5What is the importance of sacred forests and sacred lakes ?
6What is cryo preservation ?Give its one use .
7What are the major causes of species losses in geographic regions ?

Chapter-16 Environmental Issues

S. NO	CHAPTER	Concepts	Degree of imp.	Ref. NCERT text book.: page nos	Common errors
16.	Environmental issues	5. Air Pollution and its control	**	Fig. 16.1	Advantages of CNG over Petrol or diesel.
			***	Page 270-273	Norms of Air Pollution.
		(ii) Case study of Delhi	**	Page 272-273	Types of impurities & their nature in domestic sewage.
		6. Water pollution and its control	***		Effect of Sewage discharge on characteristies of river
		(i) Domestic Sewage & Industrial effluents	***	Page-274	
			***	Fig.16.2,16.3	Concentraion of toxic substances at various trophic levels
			***		
		(ii) Algal Bloom		Page 275	
		(iii) BOD	***	Page- 275	Types of e-wastes & the metals extracted.
		(iv) Eutrophication	***	Page-276	
		(v) Biomagnification	*	Fig. 16.5	
			**	Page-276	
		7. Solid waste			
		(i) Case study of remedy for plastic waste.		Page-279	
				Page-279	
		(ii) Electronic	***	Page-279	Role of UV-B radiations

		waste		Page-280	
		8. Ago chemicals & their	***	Page-280	
		effects	**	Page-280-	
		(i) Case study of organic		282 Fig.	
		farming		16.6,16.7	
		5. Radioactive wastes			
		6.Greenhouse effect and			
		Global Warming			
		(i) Green house gases &			
		their relative contribution		Page-282-	
		to total global warming		283	
		7. Ozone depletion in		Page-284-	
		Stratosphere		285	
		8. Deforestation:- Case			
		study of conservation.			

- **ACCELERATED EUTROPHICATION** :- The acceleration of aging process of water by human’s activities like effluents from the industries and homes.
- **AGRO-CHEMICALS** :- The chemicals used in agriculture such as inorganic fertilizers, pesticides, herbicides, fungicides etc. are called agro-chemicals.
- **ALGAL BLOOM** :- Presence of large amount of nutrients in water that cause excessive growth of free floating algae.
- **Biochemical Oxygen Demand (BOD**) :- The amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidized by bacteria.
- **BIOMAGNIFICATION** :- The increase in concentration of the toxicant at successive trophic levels.
- **DESERTIFICATION** :- When large barren patches of land extend and meet over time, a desert is created.
- **EUTROPHICATION** :-The natural aging of a lake by Biological Enrichment of its water.

- **E-WASTE** :- Irreparable computers and other electronic wastes
- **GREEN HOUSE EFFECT** :- The naturally occurring phenomenon that is responsible for heating of Earth's surface and atmosphere.
- **INTEGRATED ORGANIC FARMING** :-A Cyclical, zero waste procedure, where waste products from one process are cycled in as nutrients for other processes.
- **MUNICIPAL SOLID WASTES** :- The wastes from homes offices, stores, schools, hospital etc. that are collected and disposed by municipality.
- **NOISE** :- The undesired high level of sound.
- **POLLUTANTS** :- Agents that bring about undesirable change in air, water land or soil are called pollutants.
- **POLLUTION** :- Any undesirable change in physical, chemical or biological characteristics of air, land, water or soil.
- **POLYBLEND** :- A fine powder of recycled modified plastic.
- **REFORESTATION** :- The process of restoring a forest that once existed but was removed at same point of time in the past.
- **SANITARY LANDFILLS** :- The process in which wastes are dumped in a depression or trench after compaction and covered with dirt everyday.
- **SNOW-BLINDNESS CATARACT** :- High dose of UV-B causes inflammation of cornea.
- **SOIL EROSION** :- Removal of fertile top soil due to human activities over – cultivation, deforestation etc.
- **WATER LOGGING** :-The stagnation of water in the field due to irrigation without proper drainage of water.

DIFERENCES

Primary pollutants	Secondary pollutants
1.These enter our atmosphere directly from different sources and these may be solid ,liquid and gas. 2.e.g.CO,CO_2,SO_2,N_2O	1.These are formed during chemical reaction b/w primary and other atmospheric pollutants 2.e.g.smog, brown air.

Deforestation	Desertification
1.It is called the cutting and clearing of forests. 2.Caused due cattle grazing, urbanization and industrialisation.	1.It is the conversion of grassland into desert. 2.Caused due to cattle grazing and soil erosion.

ASSIGNMENTS

LEVEL 1

1. Define eutrophication.
2. What is biomagnification?
3. What is BOD?
4. Which is the world's most problematic weed, also known as —terror of Benga
5. Differentiate between biodegradable and non-biodegradable wastes.
6. Describe Chipko Movement.
7. Mention harmful effects of noise pollution on human health

LEVEL 2

1. What is meant by algal blooms? What is its significance?
2. What is Jhum cultivation?
3. What is snow blindness?
4. Mention the harm caused by fine particulate matter to human beings?
5. What are the advantages of Organic farming?
6. How do radioactive wastes cause damage to living organism?
7. What measures should be taken to reduce global warming?
8. Write a short note on ozone depletion.

LEVEL 3

1. What is the effect of DDT in birds?
2. Why are nuclear wastes called potent pollutants?
3. Mention two problems that have arisen due to green revolution.
4. What is ecological sanitation? What are its advantages?
5. How can we reduce automobile pollution?
6. Mention the adverse effects agrochemicals
7. Mention the Supreme Court directions to the Government to reduce pollution.
8. a) Explain the functioning of electrostatic precipitator with the help of a diagram.
   b) Mention the consequence if the electrostatic precipitator does not work in a power plant.

QUESTIONS FOR SELF EVALUATION

1. What do you mean by point source pollution ?
2. What is the cause of minimata disease ? Write its symptoms .
3. Which type of UV radiations can be lethal to the organisms ?
4. Expand the term PAN ?
5. Write constituents of smog ?

6BOD of two samples of water A and B were 120 mg./L and 400 mg./L .respectively .Which sample is more polluted ?
7How do human activities cause deforestation ?
8 DISCUSS e –wastes.
9 Write a note on acid rain .
10 Discuss the causes and effects of global warming .

Preface

Central Board of Secondary Education (CBSE), whose educational process is inclusive of co-scholastic areas of life skills, attitude and values, sports and games as well as co-curricular activities, is aiming to strengthen its education system in the area of value education. For the same, the board will be introducing value-based questions in the papers of final examinations in all major subjects for classes XI and XII from the academic session 2012-13.

The Board has decided to assess students for 5 percent weight age in classes XI and XII through questions which will be integrated with the content of the subject and analyzed on the basis of the values it reflects. The questions will be 3-4 marks in a question paper of 70-90 marks.

The sample value based questions deal with the life skills and values attained by students like Self Awareness, Empathy, Critical thinking, Creative Thinking, Decision Making, Problem Solving, effective Communication, Interpersonal Relationships, Coping with Stress and Coping with Anger, and Dealing With Emotions.

UNIT VI- REPRODUCTION

- Your younger sister has seen a banana tree in backyard of a house. She could see the fruits but no seeds. She wants to know how a new plant of banana will be produced without seed. What will you explain to your sister?

- A popular TV programme shows in some village, girls are killed soon after their birth. Do you approve such practice? What impact does it have on population?

- Sunita's bhabhi is not allowed to enter the kitchen during the days of her menstrual cycle. Sunita's mother thinks that she is impure and dirty and the food prepared by her is also unhygienic. Give your opinion about such traditional belief.

- Monika is a sex worker. You are a NGO worker. You are given the responsibility to educate the sex worker about sexually transmitted diseases. Specify any two ways of prevention from such diseases.

- Neeru and Narim have a three year old daughter. During her second pregnancy she wants to go for sex determination test and if needed medical termination of pregnancy. Do you think her decision is right? Justify your answer.

- Nidhi is a class VI student visits a field and finds that all the flowers of some plant are ‘closed’. She thinks such flowers will not open and due to no pollination seeds will not be formed. Such plants will be ‘propagated’ vegetative. Do you agree with Nidhi’s findings? Explain.

- Pooja’s grandmother blames her mother for giving birth to three daughters and wants another marriage of her son. Is it right to blame a female for sex determination? Justify your answer.

- Maya saw a farmer spraying some chemical on flowers, on asking she came to know that this act will lead to the formation of fruits without fertilization. Maya thinks that fruits such developed are not good to eat as chemicals are sprayed on it. Explain the difference between such spray and usual pesticide spray.

- Rahul and his friends are having discussion about a recently released movie in which hero is a sperm donor. His friends say that sperm donation is a means to earn money. Rahul explains that sperm donation can help infertile couples. Whom do you think is right? In which type of infertile cases such sperm donation is helpful. Draw a neat and labeled diagram of a sperm.

UNIT VII - GENETICS AND EVOLUTION

- Swati is dark skinned and children of her class tease her. Renu tries to help and explains her classmates that skin color is an inherited character, so they should stop teasing Swati. Name the type of inheritance involved in skin coloration of humans.

- Alok was rejected for driving license as it was found that he could not distinguish between red and green color. What would be the impact of his color blindness on his driving on road?

- A couple fights frequently for the paternity of their child. The husband thinks that he is not the father of this child. Name the technique you will suggest to solve the problem of paternity.

- You must have read in the news paper that some children suffering from Thalesemia became HIV positive due to negligence of a hospital. What negligence has been made on part of hospital authorities in your opinion?

- Rohit meets an accident. Iqbal his schoolmate takes him to hospital where Rohit (AB blood group) needs blood transfusion. Iqbal also has AB blood group and is willing to donate his blood but Rohit's mother object by saying "Iqbal belongs to different community so has different type of blood." In your opinion Rohit's mother is wrong or right? Give your opinion by explaining the allelic composition of blood group AB.

- Mohit had severe pain in his last molar tooth. Doctor advised the tooth to be removed. Mohit's sister objected saying that this was 'wisdom tooth' and is responsible for his IQ. Mohit followed doctor's advice and got his tooth extracted. Do you think Mohit will fail in his final examinations? Justify your answer by naming the type of structures the 'wisdom tooth" is?

- Kavita's parents suffer from high blood pressure and are obess. Kavita is also worried about her health. Do you think kavita can inherit these characteristic from parent. Suggest two measures kavita can adopt to avoid high blood pressure and obesity.

- Roshan a 5yr child in neighborhood is suffering from Down's syndrome. Other children in your locality do not interact with him.
    - Is it right not to interact with Roshan

- What is the cause of Down's Syndrome
- Write any two Symptoms.

- The day next to heavy rains, many insects/moths can be seen near light sources. Some people believe that these insects develop from mud. Do you agree with this belief? What is theory of origin of life known as? How will you explain the development of these insects from mud?

- According to the human Genome Project, almost 99.9% nucleotide bases are exactly the same in all people.
    - Do you think the discrimination of people on the basis of color, creed, caste, religion is correct? Why?
    - What percentage of the human genome codes for proteins?
    - Which chromosome has most genes on it?

UNIT VIII- Biology in Human Welfare

- After a rainy day Rahul found many dragon flies flying over stagnant water. He thinks these flies come to drink water. Is Rahul's explanation correct? Give your views.

- Nowadays capsules of Spirulina are used as food supplements. Do you recommend the use of these capsules? Why?

- Sunita finds that after few periods of teaching classroom is littered with many small pieces of papers. Next day she delivered a speech in assembly-"if a paper is torn a branch of tree is being destroyed." Do you agree with Sunita? Give reasons.

- Anita believes that breastfeeding her new born child would spoil her figure and also make her weak. Do you think Anita is right? If not, how would you convince her?

- Delhi govt. has recently decided to ban the sale of Gutka (this fetches them a lot of monetary gain) in the state. Do you support the decision and Why?

- You go to a super market to buy rice. Two types of products are available- one is organically grown and second is conventionally grown. The organically grown crops are costlier so your mother does not want to purchase it. Convince your mother by telling her the advantages of organic foods.

- Municipal Corporation has deputed personnel to check for mosquito breeding in your school.

  a) Which are the places they should check for mosquitoes and there larvae?

  b) Name to diseases which are spread by mosquitoes.

  c) Name any two biological agents which can be used to control mosquitoes

- Prabha has seen huge garbage dumps outside your school which are not being regularly disposed of by MCD. Prabha discusses the problems with school mates and decide to organize rally to spread awareness among local people about public hygiene.
    - Prepare two slogans for rally
    - Name any two infectious diseases which may spread due to such unhygienic conditions at public place

- Anand a 14yr old boy thinks smoking makes him more energetic and feel like adult and thus more responsible citizen. He tries to smoke when he is with his peer group. As a friend you have to educate him
    - Why he feels more energetic while smoking?
    - Effects of CO in smoke
    - Other ill effects on body

- Ram is managing a dairy firm. He has been advised to use artificial insemination to overcome several problems in developing better breeds of cow. Govind has advised him MOET for herd improvement. Ram is ignorant and is not able to decide. How will you help Ram regarding

- Which technique should he adopt
- Procedure of new technique
- What is advantage of this technique

UNIT IX - BIOTECHNOLOGY

- A newspaper has reported that an American company has patented turmeric. Indian government is fighting against this patent. What will you call this act of American company?

- Sangeeta has developed a transgenic crop. She wants to grow this crop directly into the field. Will you allow her to do so? What will you suggest her?

- Arvind s mother has developed Diabetes. Doctor suggests her to take Insulin injections. But his mother declines as she presumes injections are prepared by slaughtering of animals .How will you solve his mother's problem with your knowledge of biotechnology?

- Inspector Dubey could find only few hair strands from crime scene. He wants to proceed for DNA fingerprinting but the amount of DNA is very less. In your opinion what could be the solution to this problem? Write the basic steps of this technique?

- Sunil's uncle is very worried as his crop is destroyed by insects. He suggests his uncle to use Bt crops. His uncle says that such crops produce toxins which can harm the consumers of this crop. Whom do you support and why?

UNIT X- ECOLOGY

- The city government is planning to bring metro rail to your area. But this will require around 10,000 trees to be cut. Do you think govt. should go ahead with the project? Justify your answer?

- You find that a lake in your neighboring area has been covered by Water hyacinth. You have contacted your friends to remove this weed. Nobody agrees to support you .How will you explain the necessity of this?

- Now a days we see that people use CD's and DVD's for storing information, movies and songs. Do you think these things create pollution?

- Government of India has launched clean Ganga programme by the name Ganga Action Plan. Do you want to be a part of it? How?

- You have read the newspaper reports that lots of cows die because of polythene bags getting entangled in their intestine. You go to market and see vegetable vender selling vegetables in plastic bags. What will be your suggestion to - (i) buyer and (ii) seller?

- One of your friends Rakesh has gone to jungle safari with his family. On returning from that safari he is sharing experiences with you and tells that his father who is a businessman hunted a deer with his gun. What will you tell your friend after knowing about their expedition?

- Pankhuri watched a TV program based on life in polar region. She observed that all the animals in polar region possess larger size and smaller animals are not found in that region. She asked about this surprising fact to her friends. Being her friend, how can you satisfy her curiosity?

- Ajay a notorious boy often involved in destruction of surrounding plants and killing small animals. You are given a responsibility to make him understand about importance of each and every organism present in world. How can you explain him about it and which hypothesis you will use for it?

- A well known personality killed a back buck during hunting in sacred groves of Aravali Hills in Rajasthan. Local people caught him and lodged a case in court against him. He argued that court that killing a human being is a crime but killing a animal is not crime.

- Do you favor his argument? Why?
- What is the role of scared groves? Mention any two names of such places other than Aravali Hills.

- Anil and Sunil are partners and established a factory. After a few months electrostatic precipitator became out of order. Sunil wanted to replace it but Anil expressed the view that they have no effect of it on productivity as well as income; therefore they should not waste money to replace it.

  (a)Out of these partners whom do you support and why?

  (b) Suggest any two measures to stop such negligence.

- A team of research workers observed that the population of fish eating birds is declining every year after the establishment of a pesticide factory nearby five years ago.

  (a) What may be the possible reason in your opinion? Explain?

  (b) Can you suggest alternative to pesticide so that factory may be stopped.

- A few months ago the people of Ramgarh started a bad practice of disposing their waste in the pond of village which was earlier source of drinking water. It resulted in deterioration of quality of water and fish mortality.

(a) What changes do you think have taken place in pond? Name such condition.
(b) What measure will you take to stop villagers for such practices as well as to improve the condition?

UNIT-6 Reproduction

Answers & Values

- In banana the vegetative propagation is with the help of rhizome

Values

- *Awareness*
- *Observation*

2. No, I do not approve such practice as girls are equally important in the society. Otherwise the sex ratio will decrease.

Values

- *Sensitivity to words others*
- *Awareness*

3. Menstrual cycle is a normal process in the body of female which helps in reproduction.

Values

- *Self awareness about body.*
- *Compassion for others.*

4. a) Always use condom during coitus

b) in case of doubt of any disease consult doctor

Values

- *Services to society*
- *Compassion*
- *Awareness of STD*

5. No

Sex determination and MTP is not legal

Values

- *Should be ethical*
- *Awareness*

6. No the flowers which do not open can have self pollination and produce seed. They can be propagated through seed.

Values

- *Concern about plants*
- *Observation*
- *Critical thinking*

7. No. Female produces all eggs with X chromosomes while male is heterogametic and produce two types of gametes X and Y. It is the fusion of his gamete (X or Y) with egg of X type which determine the sex of baby

Values

- *Understanding.*
- *Respect for female.*

8. The chemical sprayed by farmer is growth hormone which will induce parthenocarpy. This is not causing any harm to fruit or to the health of consumer. Pesticides are harmful to human health.

Values

- Sensitivity and awareness about use of chemicals.
- observation

9. a) Rahul is right . As it helps infertile couples. It is helpful in following cases

I) Inability of male partner to inseminate.

II) Very low sperm count.

Values

- *Courage*
- *Believing that "other" can make a world of difference*
- *Compassion for others*

Unit-7 Genetics and Evolution

Answers & Values

- Quantitative /Polygenic inheritance

Values

- *Sensitivity towards fellow beings.*
- *Compassion.*
- *Understanding*

- He will not be able to distinguish between red and green signal on road. This may lead to an accident

Values

- *Responsibility*
- *Awareness*

- DNA Fingerprinting

  Values

  - *Compassion.*
  - *Empathy.*

- During transfusion of blood to thalesemic patient.
  - Blood might have been contaminated.
  - Sterile needles/ injection were not used

Values

- *Critical thinking*
- *Awareness about health*
- *Empathy.*

- Wrong.

  Blood Group AB has two alleles A and B in the people of all communities

  Values

  - *Sensitivity towards fellow beings.*
  - *Compassion for others*
  - *Responsibility.*

- No. “Wisdom tooth” Has nothing to do with IQ or performance of any person. It is vestigial organ which can be remove

Values

- *Awareness.*

- 1) No, these are life style related diseases

  2) Any two measures- changing in food habits, exercises, leading active life, meditation.

  Values

  - *Awareness about health.*
  - *Understanding.*

- 1) No.

  2) Genetic disorder due to trisomy.

  3) Any two symptoms.

  Values

  - *Empathy.*
  - *Concern.*

- No

  Spontaneous generation theory

  Values

- *Awareness about environment.*
- *Understanding.*

Unit-8 Biology in Human Welfare

Answers & Values

- No, dragon flies eat mosquito larva and act as bio control agents.

  Values

  - *Awareness about environment*
  - *Critical thinking.*

- Yes

Any one reason –these are rich in proteins and can be produced in large quantities in less time.

Values

- *Awareness.*
- *Problem solving.*

- Yes, wood is used in manufacturing of paper.

  Values

  - *Sense of responsibility.*
  - *Awareness.*

- No, Her figure will not be spoilt

  By telling the advantages of breast feeding.

  Values

  - *Self awareness.*
  - *Sense of responsibility.*

- Yes Gutka increases the changes of cancer

  Values

  - *Awareness of Govt. Policies.*
  - *Consciousness to words health*

- Advantages of organic farming like – biofertilisers and bio pesticides are used in organic farming which is not harmful to health.

Values

- *Sensitivity and awareness about use of harmful chemicals*
- *Decision making.*

- A) water tanks , flowerpots, stagnant water
  - Dengue, Malaria
  - Gambusia, dragonfly

  Values

  - *Observation*
  - *Sensitivity towards health.*

- 1) Any slogans.

  2) Diseases like typhoid and amoebiasis.

  Values

  - *Responsibility.*
  - *Sensitivity towards public. Hygiene*
  - *Problem solving.*

- i) He fells energetic because nicotine raises blood pressure and increases heart beat. This is not good for his health.

  ii) CO binds to hemoglobin and reduces concentration of oxygen

  iii) Any one effort cancer of lung, throat, emphysema.

  Values

  - *Awareness about health*
  - *Consciousness.*
  - *Critical thinking.*

- I)MOET as success rate of this technique is more

  II) Cow is administered hormones, with FSH like activity, to induce follicular maturation and super ovulation-(6-8 eggs). The animal is mated. Fertilized eggs are recovered and transferred to surrogate mother.

  III) Herd size is increased in short time.

  Genetic mother is available for another round of super ovulation.

Values

- *Critical thinking*
- *Problem solving.*

Unit –IX Biotechnology

Answers & Values

- Biopiracy.

  Values

  - *Awareness*
  - *Justice for country.*

- Insulin can also be synthesized in laboratory with r DNA

  Values

  - *Empathy.*
  - *Awareness*
  - *Concern.*

- No, as GMO may pose some threat to environment or living organism

  I will ask her to approach GEAC.

  Values

- *Sense of responsibility.*
- *Understanding.*

- He can amplify DNA with the help of PCR technique Basic steps of PCR ----
- Denaturation
- Annealing

III) Extension

Values

- *Critical thinking*
- *Awareness.*

- I support him.

Bt crops produce protoxin which changes into active form only in the intestine of insects in alkaline pH. It is completely safe for other animals and human beings

Values

- *Empathy.*
- *Awareness.*

KRISHNA
PUBLIC SCHOOL

Unit-X Ecology

Answers & Values

- Yes. But the track of metro should be so changed that minimum no of trees are cut. Track can be made underground and more trees can be planted after the project is over.

  Values

  - *Sensitivity towards environment*
  - *Decision making.*

- Friends should be explained the process of natural ageing of a lake by mineral enrichment of water. (eutrophication) which is harmful to aquatic life .

  Values

  - *Problem solving*
  - *Critical thinking.*
  - *Responsibility*

- Yes. Because all this material contain heavy metals and toxics substances and known as e-wastes.

  Values

  - *Concern about environment.*
  - *Awareness.*

- Yes I will start awareness programmes like Nukkad Nataks, rallies and slogans making to keep the river clean.

  Values

  - *Innovation*
  - *Service to society*

- I) Use cloth or jute bag to save environment and thus life of cow

  II) Use paper bags, polythene are non biodegradable and toxic.

  Values

  - *Sensitivity to words environment*
  - *Concern.*

- It is unethical and leads to loss of biodiversity and result in imbalance in Eco system.

  Values

  - *Concern about animal.*
  - *Empathy.*

- Because smaller animals have larger surface area relative their volume so they lose body heat very fast when it is cold outside. They have to expense lot of energy to generate body heat.

  Vales

  - *Critical thinking*
  - *Awareness.*

- Explanation through “Rivet popper hypothesis.

  Values

  - *Social responsibility*
  - *Concerns about eco system.*

- A) No because each living organism has its own role in balanced eco system.

  b) Sacred groves are culturally protected area where large no of rare and Threatened wild life is given total protection.

  [Any other two sacred groves]

  Values

  - *Awareness*
  - *Responsibility.*

- A) I will support Sunil because his approach is eco friendly.

  B) By imposing fine and punishment

  Cancellation of registration of such industries

  Values

  - *Decision making*
  - *Concern about environment*

- A) Pesticide entering in food chain and resulting in biomagnifications
- Bio controlling agent to remove pest

  Values

  - *Problem solving*
  - *Critical thinking.*

- A) Eutrophication – Brief explanation.

  B) Any two means of spreading awareness of disposal of waste and keeping the pond clean.

  Values

  - *Service to society*
  - *Concern about environment.*