

BIOLOGY

Academic Window

2023-2024



GRADE
12

FOREWORD

A word from HOD

Science is beautiful when it makes simple explanations of phenomena or connections between different observations. Examples include the double helix in biology and the fundamental equations of physics.Stephen Hawking

Biology, it's the technology which builds our world, and we can harness it to shift humanity from a scarcity to an abundance economy. Intrinsic motivation arises from a desire to learn a topic due to its inherent interests, for self-fulfillment, enjoyment and to achieve a mastery of the subject.

This support material is prepared by the faculty members of the Department of Biology at Delhi Private School Sharjah. This is composed and compiled based on the latest syllabus prescribed by CBSE and will be updated as and when required. The content focusses on the following key points.

- Learning objectives
- Synopsis lessons/chapter
- Important questions
- Sample Question papers

A lot of activity-based questions and high order thinking questions are included for analytical thinking. Students are suggested to go through the support material. Regular reading and practice will help them to score very good marks.

All the Best!

Ms. ANJUM HASAN

(HOD BIOLOGY)

DPS SHARJAH

GRADE-XII

Syllabus Planner – (2023-24)

S. No	Month	Name of the lesson
1.	March/April	<u>Unit 2</u> Chapter 6: Molecular basis of Inheritance Chapter-5: Principles of Inheritance and variation Chapter-1: Reproduction in Organisms
2	May/June /August	<u>Unit 9</u> Chapter-11: Biotechnology: Principles and Processes Chapter-12: Biotechnology and Application Chapter-2: Sexual reproduction in Flowering plants
4	September	<u>Unit 9</u> Chapter-2: Sexual reproduction in Flowering plants contd Chapter-3: Human Reproduction Chapter-4: Reproductive health
5	October	<u>Unit 8</u> Chapter-10: Microbes in Human Welfare Chapter 7: Evolution <u>Unit 10</u> Chapter-13: Organisms and Populations Chapter- 8: Human health and Diseases Chapter-9: Strategies for Enhancement in Food Production

6	November	<p><u>Unit 10</u></p> <p>Chapter-13: Organisms and Populations contd</p> <p>Chapter 15: Biodiversity and Conservation</p> <p>Chapter-14: Ecosystem Services</p> <p>Chapter-16: Environmental Issues</p>
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BIOLOGY (Code No. 044)

The present syllabus reinforces the ideas introduced till the secondary classes. It provides the students with new concepts along with an extended exposure to contemporary areas of the subject. The syllabus also aims at emphasizing on the underlying principles that are common to both animals and plants as well as highlighting the relationship of biology with other areas of knowledge. The format of the syllabus allows a simple, clear, sequential flow of concepts without any jarring jumps. The syllabus also stresses on making connections better among biological concepts. It relates the study of biology to real life through the use of technology. It links the discoveries and innovations in biology to everyday life, such as environment, industry, health and agriculture. The updated syllabus also focuses on reducing the curriculum load while ensuring that ample opportunities and scope for learning and appreciating basic concepts of the subject continue to be available within its framework.

The prescribed syllabus is expected to

- * promote understanding of basic principles of Biology
- * encourage learning of emerging knowledge and its relevance to individual and society
- * promote rational/specific attitude to issues related to population, environment and development
- * enhance awareness about environmental issues and problems and the appropriate solutions
- * create awareness amongst the learners about variations amongst the living,
- * developing respect for the diversity and to appreciate that the most complex biological phenomena are also built on essentially simple processes.

It is expected that the students would get an exposure to various branches of Biology in the syllabus in a more contextual and friendly manner as they study its various units.

CLASS XII (THEORY)

Unit-VI Reproduction

Chapter-2: Sexual Reproduction in Flowering Plants Flower structure; development of male and female gametophytes; pollination - types, agencies and examples; out breeding devices; pollen-pistil interaction; double fertilization; post fertilization events - development of endosperm and embryo, development of seed and formation of fruit; special modes- apomixis, parthenocarpy, polyembryony; Significance of seed dispersal and fruit formation.

Chapter-3: Human Reproduction Male and female reproductive systems; microscopic anatomy of testis and ovary; gametogenesis -spermatogenesis and oogenesis; menstrual cycle; fertilisation, embryo development upto blastocyst formation, implantation; pregnancy and placenta formation (elementary idea); parturition (elementary idea); lactation (elementary idea).

Chapter-4: Reproductive Health Need for reproductive health and prevention of Sexually Transmitted Diseases (STDs); birth control - need and methods, contraception and medical termination of pregnancy (MTP); amniocentesis; infertility and assisted reproductive technologies - IVF, ZIFT, GIFT (elementary idea for general awareness).

Unit-VII Genetics and Evolution

Chapter-5: Principles of Inheritance and Variation Heredity and variation: Mendelian inheritance; deviations from Mendelism – incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosome theory of inheritance; chromosomes and genes; Sex determination - in humans, birds and honey bee; linkage and crossing over; sex linked inheritance - haemophilia, colour blindness; Mendelian disorders in humans - thalassemia; chromosomal disorders in humans; Down's syndrome, Turner's and Klinefelter's syndromes.

Chapter-6: Molecular Basis of Inheritance Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central Dogma;

transcription, genetic code, translation; gene 8 expression and regulation - lac operon; Genome, Human and rice genome projects; DNA fingerprinting.

Chapter-7: Evolution Origin of life; biological evolution and evidences for biological evolution (paleontology, comparative anatomy, embryology and molecular evidences); Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection; Gene flow and genetic drift; Hardy - Weinberg's principle; adaptive radiation; human evolution.

Unit-VIII Biology and Human Welfare

Chapter-8: Human Health and Diseases Pathogens; parasites causing human diseases (malaria, dengue, chikungunya, filariasis, ascariasis, typhoid, pneumonia, common cold, amoebiasis, ring worm) and their control; Basic concepts of immunology - vaccines; cancer, HIV and AIDS; Adolescence - drug and alcohol abuse.

Chapter-10: Microbes in Human Welfare Microbes in food processing, industrial production, sewage treatment, energy generation and microbes as bio-control agents and bio-fertilizers. Antibiotics; production and judicious use.

Unit-IX Biotechnology and its Applications

Chapter-11: Biotechnology - Principles and Processes Genetic Engineering (Recombinant DNA Technology).

Chapter-12: Biotechnology and its Applications Application of biotechnology in health and agriculture: Human insulin and vaccine production, stem cell technology, gene therapy; genetically modified organisms - Bt crops; transgenic animals; biosafety issues, biopiracy and patents.

Unit-X Ecology and Environment

Chapter-13: Organisms and Populations Population interactions - mutualism, competition, predation, parasitism; population attributes - growth, birth rate and death rate, age distribution. (Topics excluded: Organism and its Environment, Major Abiotic Factors, Responses to Abiotic Factors, Adaptations)

Chapter-14: Ecosystem Ecosystems: Patterns, components; productivity and decomposition; energy flow; pyramids of number, biomass, energy (Topics excluded: Ecological Succession and Nutrient Cycles)

Chapter-15: Biodiversity and its Conservation Biodiversity-Concept, patterns, importance; loss of biodiversity; biodiversity conservation; hotspots, endangered organisms, extinction, Red Data Book, Sacred Groves, biosphere reserves, national parks, wildlife, sanctuaries and Ramsar sites.

Practicals 60 Periods

A. List of Experiments

- 1.Prepare a temporary mount to observe pollen germination.
- 2.Study the plant population density by quadrat method.
- 3.Study the plant population frequency by quadrat method.
- 4.Prepare a temporary mount of onion root tip to study mitosis.
- 5.Isolate DNA from available plant material such as spinach, green pea seeds, papaya, etc.

B. Study/observation of the following (Spotting)

1. Flowers adapted to pollination by different agencies (wind, insects, birds).
2. Pollen germination on stigma through a permanent slide or scanning electron micrograph.
3. Identification of stages of gamete development, i.e., T.S. of testis and T.S. of ovary through permanent slides (from grasshopper/mice).
4. Meiosis in onion bud cell or grasshopper testis through permanent slides.
5. T.S. of blastula through permanent slides (Mammalian).
6. Mendelian inheritance using seeds of different colour/sizes of any plant.
7. Prepared pedigree charts of any one of the genetic traits such as rolling of tongue, blood groups, ear lobes, widow's peak and colour blindness.
8. Controlled pollination - emasculation, tagging and bagging.
9. Common disease causing organisms like Ascaris, Entamoeba, Plasmodium, any fungus causing ringworm through permanent slides, models or virtual images or specimens. Comment on symptoms of diseases that they cause.
- 10.Models specimen showing symbiotic association in root modules of leguminous plants, Cuscuta on host, lichens.
- 11.Flash cards models showing examples of homologous and analogous organs.

SYNOPSIS
CHAPTER -1
REPRODUCTION IN ORGANISMS

- Reproduction is defined as a biological process in which an organism gives rise to young ones (offspring) similar to itself. The offspring grow, mature and in turn produce new offspring.
- Asexual reproduction: When offspring is produced by a single parent with or without the involvement of gamete formation, the reproduction is called asexual.
- Asexual reproduction is common among single-celled organisms, and in plants and animals with relatively simple organizations.
- The offspring formed by asexual reproduction are identical and are referred to as clones.
=>Binary fission- Amoeba, Paramecium
- Yeast:- In yeast, the division is unequal and small buds are produced
- Members of the Kingdom Fungi and simple plants such as algae reproduce through special asexual reproductive structures like zoospores ,conidia (Penicillium), buds (Hydra) and gemmules (sponge).
- Vegetative propagation: In plants, when offspring is produced by a single parent with or without the involvement of gamete formation, , it is called vegetative reproduction
- In plants, the units of vegetative propagation are runner, rhizome, sucker, tuber, offset and bulb.
- These are all capable of giving rise to new offspring. These structures are called vegetative propagules.
- Vegetative propagules in angiosperms:
(a) Potato- Eyes/ buds (b) Ginger - Rhizome (c) Agave - Bulbil
(d) Bryophyllum --- Leaf buds of (e) water hyacinth-- Offset

Sexual reproduction:-When two parents (opposite sex) participate in the reproductive process and also involve fusion of male and female gametes, it is called sexual reproduction.

Sexual reproduction

- Sexual reproduction involves formation of the male and female gametes,
- These gametes fuse to form the zygote which develops to form the new organism. It is an elaborate, complex and slow process.
- Offspring that produced are not identical to the parents or amongst themselves.

- Organisms like algae and fungi resort to sexual reproduction just before the onset of unfavorable conditions and they form thick walled zygote that is resistant to desiccation and other damages and it undergoes dormancy during this condition.
- Juvenile phase / Vegetative phase
- The period of growth shown by all organisms to reach a certain stage of growth and maturity in their life, before they can reproduce sexually. is called the juvenile phase in animals and vegetative phase in plants.
- This phase is of variable durations in different organisms.
- The end of juvenile/vegetative phase marks the beginning of the reproductive phase .it is the period in the life of an organism after I attain reproductive maturity.
- Bamboo species flower only once in their life time, generally after 50-100 years Strobilanthus kunthiana (neelakuranji),flowers once in 12 years.
- cyclical changes during reproduction in non-primate mammals are called oestrus cycle
- Oestrus cycles ----cows, sheep, rats, deers, dogs, tiger.
- cyclical changes during reproduction in non-primate mammals are called menstrual cycle. example monkeys, apes, and humans.
- Seasonal breeder :In few organisms cyclical changes during reproduction will be exhibited only during favorable seasons in their reproductive phase and are therefore called seasonal breeders
- Continous breeders :Many other mammals are reproductively active throughout their reproductive phase and hence are called continuous breeders.
- Events in sexual reproduction. Sexual reproduction is characterized by the fusion (or fertilization) of the male and female gametes, the formation of zygote and embryogenesis. These sequential events may be grouped into three distinct stages namely,the pre-fertilisation, fertilisation and the post-fertilisation events.

Pre-fertilisation

- These include gametogenesis and gamete transfer.
- Gametogenesis is the process of formation of the two types of gametes – male and female.
- Gametes are haploid cells.
- >In some algae, the two gametes are so similar in appearance and are hence called homogametes (isogametes)
- In a majority of sexually reproducing organisms the gametes produced are of two morphologically distinct types and are called heterogametes.
- In such organisms the male gamete is called the antherozoid or sperm and the female gamete is called the egg or ovum.
- Homothallic and monoecious are used to denote the bisexual condition. In this male and female reproductive organs are present in the body of same individual.
- Heterothallic and dioecious are the terms used to describe unisexual condition.
- In this male and female reproductive organs are present on different individual.
- In flowering plants, the unisexual male flower is staminate.
- While the female is pistillate or bearing pistils.

- In some flowering plants, both male and female flowers may be present on the same individual is called monoecious.

Monoecious plants: --- a cucurbits and coconuts

- Both male and female flowers may be present on separate individuals is called dioecious).
 - Example dioecious plants :---papaya and date palm.
- Some bisexual animals that possess both male and female reproductive organs, are hermaphrodites. -example---Earthworms, sponge, tapeworm and leech

Cell division during gamete formation :

- Gametes in all heterogametic species are of two types namely, male and female.
- Gametes are haploid.
- A haploid parent produces gametes by mitotic division.
- monera, fungi, algae and bryophytes have haploid plant body
- organisms belonging to pteridophytes, gymnosperms, angiosperms and most of the animals including human beings, the parental body is diploid.
- Meiosis occur in a diploid body to produce haploid gametes.
- In diploid organisms, specialized cells called meiocytes undergo meiosis.
- At the end of meiosis, only one set of chromosomes gets incorporated into each gamete.

Gamete Transfer

- After their formation, male and female gametes must be physically brought together to facilitate fusion (fertilization).
- Male gamete is motile and the female gamete is stationary.
- In few fungi and algae both types of gametes are motile
- There is a need for a medium through which the male gametes move.
- In several simple plants like algae, bryophytes and pteridophytes, water is the medium through which this gamete transfer takes place.
- In seed plants, pollen grains are the carriers of male gametes and ovule has the egg.
- In bisexual, self-fertilising plants, e.g., peas, transfer of pollen grains to the stigma is relatively easy as anthers and stigma are located close to each other.
- But in cross pollinating plants (including dioecious plants), a specialised event called pollination facilitates transfer of pollen grains to the stigma.
- In dioecious animals, since male and female gametes are formed in different individuals, the organism must evolve a special mechanism for gamete transfer. Successful transfer and coming

together of gametes is essential for the most critical event in sexual reproduction, called fertilization

Fertilization

- The fusion of gametes called syngamy results in the formation of a diploid zygote.
- Organisms like rotifers, honeybees and even some lizards and birds (turkey), the female gamete undergoes development to form new organisms without fertilization. This phenomenon is called parthenogenesis.
- If syngamy occurs outside the body of the organism. It is called external fertilisation. Example -algae and fishes as well as amphibians,
- If syngamy occurs inside the body of the organism, the process is called internal fertilisation.
- In all these organisms, egg is formed inside the female body where they fuse with the male gamete. Post-fertilisation events.
- Events in sexual reproduction after the formation of zygote are called post-fertilisation events.
- Further development of the zygote depends on the type of life cycle of the organism and the environment it is exposed to.
- In organisms belonging to fungi and algae, zygote develops a thick wall that is resistant to desiccation and damage. It undergoes a period of rest before germination.
- In organisms with haplontic life cycle, zygote divides by meiosis to form haploid spores that grow into haploid individuals.
- Zygote is the vital link that ensures continuity of species between organisms of one generation and the next.

Embryogenesis

- Embryogenesis refers to the process of development of embryo from the zygote.
 - During embryogenesis, zygote undergoes cell division to increase the number of cells .cell differentiation helps groups of cells to undergo certain modifications to form specialized tissues and organs to form an organism
 - Based on whether the development of the zygote take place outside the body of the female parent or inside, i.e., whether they lay fertilised/unfertilised egg or give birth to young ones , animals are categorized into oviparous and viviparous
 - In flowering plants, the zygote is formed inside the ovule.
 - After fertilization the sepals, petals and stamens of the flower wither and fall off. The pistil remains attached to the plant.
 - The zygote develops into the embryo and the ovules develop into the seed.
 - The ovary develops into the fruit which develops a thick wall called pericarp that is protective in function.
 - After dispersal, seeds germinate under favorable conditions to produce new plants.
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CHAPTER 1 : REPRODUCTION IN ORGANISMS

1 MARK QUESTIONS-MCQ's

1. A few statements describing certain features of reproduction are given below:
 - i. Gametic fusion takes place
 - ii. Transfer of genetic material takes place
 - iii. Reduction division takes place
 - iv. Progeny have some resemblance with parentsSelect the options that are true for both asexual and sexual reproduction from the options given below:
 - (a) i and ii;
 - (b) ii and iii;
 - (c) ii and iv;
 - (d) i and iii.
2. The term ‘clone’ cannot be applied to offspring formed by sexual reproduction because:
 - a. Offspring do not possess exact copies of parental DNA
 - b. DNA of only one parent is copied and passed on to the offspring
 - c. Offspring are formed at different times
 - d. DNA of parent and offspring are completely different.
3. Amoeba and Yeast reproduce asexually by fission and budding respectively, because they are:
 - a. Microscopic organisms
 - b. Heterotrophic organisms
 - c. Unicellular organisms
 - d. Uninucleate organisms.
4. A few statements with regard to sexual reproduction are given below:
 - i. Sexual reproduction does not always require two individuals
 - ii. Sexual reproduction generally involves gametic fusion
 - iii. Meiosis never occurs during sexual reproduction

iv. External fertilization is a rule during sexual reproduction

Choose the correct statements from the options below:

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

9. Which of the following situations correctly describe the similarity between an angiosperm egg and a human egg?

- i. Eggs of both are formed only once in a lifetime
- ii. Both the angiosperm egg and human egg are stationary
- iii. Both the angiosperm egg and human egg are motile transported
- iv. Syngamy in both results in the formation of zygote

Choose the correct answer from the options given below:

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

10. Appearance of vegetative propagules from the nodes of plants such as sugarcane and ginger is mainly because:

- a. Nodes are shorter than internodes
- b. Nodes have meristematic cells
- c. Nodes are located near the soil
- d. Nodes have non-photosynthetic cells

ASSERTION REASON

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

Q.1. Assertion: Asexual reproduction is also known as blastogenesis.

Reason: There is no formation and fusion of gametes in asexual reproduction.

Q.2. Assertion: Asexual reproduction involves formation of clones of an organism.

Reason: Clones are morphologically and genetically similar individuals.

Q.3. Assertion: Algae and fungi switch to asexual method of reproduction before the onset of adverse conditions.

Reason: Asexual reproduction may introduce variations and leads to the formation of many clones.

Q.4. Assertion: The life span of plants is greater than animals.

Reason: Plants continue their growth at their tips.

Q.5. Assertion: Organisms that reproduce by binary fission are immortal.

Reason: Such organisms have special kind of rejuvenation capability.

CASE BASED

Given below is the diagram of a ginger rhizome. Answer the questions given below based on the diagram.

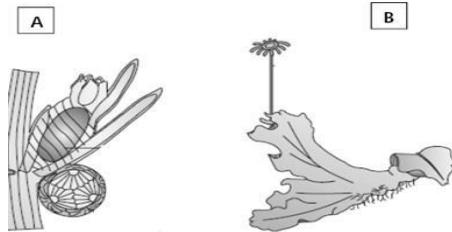


- (i) Why do vegetative propagules in sugarcane and ginger appear from the nodes?
- (ii) Name the vegetative propagules in (a) Potato, and (b) Pistia.
- (iii) How does potato multiply?

2 MARK QUESTIONS

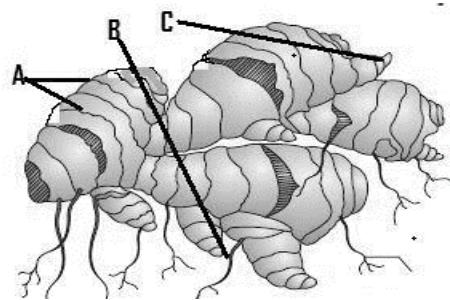
1. Off springs of sexual reproduction have a better chance of survival. Why?
2. How do the following organisms reproduce?
a) Amoeba b) paramecium
c) Yeast d) penicillium e) Sponge
3. Name the vegetative propagules of-
a) Potato b) Ginger
c) Agave d) Water hyacinth
4. What kind of development takes place in zygote in organisms with diplontic and haplo-diplontic life cycles?
5. Why is water hyacinth known as scourge of water bodies / terror of Bengal?
6. Name two animals showing-
a) Oestrus cycle b) Menstrual cycle
7. Give the ploidy of the following-
a) Antherozoid b) Meioocyte
c) Parental body in pteridophytes d) Zygote
8. Male gametes are produced in huge numbers in comparison to female gametes. Why?

9. Rafi wanted to grow banana plants in his orchard. He selected stem cuttings of banana as vegetative propagule. Comment on his choice giving reasons.
10. (i) Identify the given plants
(ii) How are they different from their reproductive organs?



3 MARK QUESTIONS

1. Name the following organisms
- | | |
|------------------------|--------------------------|
| i) bisexual organism | ii) unisexual organism |
| iii) monoecious algae | iv) dioecious bryophytes |
| v) bisexual flower | |
| vi) algae that produce | |
| a) heterogametes | b) oogametes |
2. Neelakurinji flowers once in 12 years.
- Give its scientific name.
 - When did it last flower?
 - Where is it found in India?
3. Complete the following table-
- | Name of organism | Chromosome number in meiocyte | Chromosome number in gamete |
|------------------|-------------------------------|-----------------------------|
| Human beings | A | 23 |
| Butterfly | 380 | B |
| Apple | 34 | C |
| Onion | D | 16 |
| Ophioglossum | E | 630 |
| Dog | 78 | F |
4. a) Label A, B and C in the diagram above.
b) Which one of these aids ginger in vegetative reproduction?



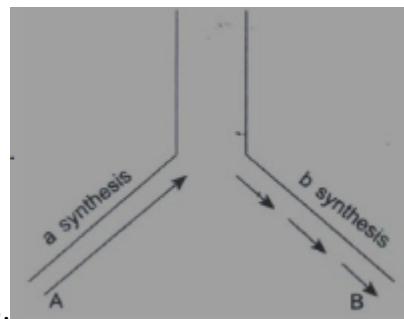
5. a) Define life span of an organism.
b) Give the average life span of-
i) Banyan tree
ii) Crocodile
iii) Crow
iv) Butterfly

6. The cleistogamous flower of oxalis undergoes self-pollination. What could be the disadvantage of this to the plant? Mention any two ways how self-pollination is escaped in some plants.
7. Tapeworms possess both male and female reproductive organs. What is the name given to such organism? Give two more examples of such organisms. 8. Give appropriate scientific term for each of the following
- Fruit developing without fertilization
 - Formation of embryo from unfertilized egg
 - Vegetative propagation of plant through tissue culture

5 MARK QUESTIONS

CASE BASED

1. A DNA replication fork is shown below. Answer the following questions based on that.
- Why does DNA replication occur in such small forks?
 - What is a synthesis and b synthesis?



- (iii) Mention the polarity at A and B.

- a) What are the three clear cut phases in the life of annual and biennial type of plants?
b) Why is it difficult to define these phases in perennial species of plants?
 - Tabulate and explain the post-fertilization changes in a plant.
 - What do you mean by the following terms
a. Isogametes b. Heterogametes c. Antherozoid d. Homothallic (monoecious)
e. Heterothallic (dioecious) f. Staminate g. Pistilate h. Hermaphrodites
-

SYNOPSIS
CHAPTER -2
SEXUAL REPRODUCTION IN FLOWERING PLANTS

- Flowers are morphological and embryological marvels and the sites of sexual reproduction. Several hormonal and structural changes are initiated which lead to the differentiation and further development of the floral primordium.
- Flower has the male and female reproductive structures called the androecium and the gynoecium.
- Androecium :It consists of a whorl of stamens representing the male reproductive organ.

Parts of stamen –

- It has long and slender stalk called the filament, and the terminal generally bilobed structure called the anther. The proximal end of the filament is attached to the thalamus or the petal of the flower.
- Anther is bilobed with each lobe having two theca, (dithecos)
- The anther consists of four microsporangia located at the corners, two in each lobe.
- The microsporangia develop further and become pollen sacs and they are packed with pollen grains.

Structure of microsporangium:

- Circular in outline.
- It is generally surrounded by four wall layers, Called – the epidermis, endothecium, middle layers and the tapetum.
- The outer three wall layers perform the function of protection and help in dehiscence of anther to release the pollen.
- The innermost wall layer tapetum, nourishes the developing pollen grains.
- A group of compactly arranged homogenous cells called the sporogenous tissue occupies the centre of each microsporangium.

Microsporogenesis :

- The cells of the sporogenous tissue undergo meiotic divisions to form microspore tetrads. Each cell of the sporogenous tissue is a potential pollen or microspore mother cell (PMC).
- The process of formation of microspores from a pollen mother cell through meiosis is called microsporogenesis.
- As the anthers mature and dehydrate, the microspores will be released

Pollen grain

- The pollen grains represent the male gametophytes. It has a prominent two-layered wall.
- The hard outer layer called the exine is made up of sporopollenin which can withstand high temperatures and strong acids and alkali.
- Exine has prominent apertures called germ pores where sporopollenin is absent.
- The inner wall of the pollen grain is called the intine, made up of cellulose and pectin.
- The cytoplasm of pollen grain is surrounded by a plasma membrane. Mature pollen grain contains two cells, the vegetative cell and generative cell
- The vegetative cell is bigger, has abundant food reserve and a large irregularly shaped nucleus.

- The generative cell is small and floats in the cytoplasm of the vegetative cell. It is spindle shaped with dense cytoplasm and a nucleus.

GYNOECIUM

- The gynoecium represents the female reproductive organ
- If gynoecium has single pistil ,it is called monocarpellary
- If gynoecium has more than one pistil ,it is called multicarpellary.
- When there are more than one, the pistils may be fused together and the condition is called syncarpous
- When there are more than one, may be free (apocarpous)
- Pistil has three parts the stigma, style and ovary.
- The stigma serves as a landing platform for pollen grains.
- The style is the elongated slender part beneath the stigma.
- The basal bulged part of the pistil is the ovary.
- The ovarian cavity ,inside the ovary is called locule
- The placenta is located inside the ovarian cavity.

Pollen tablets : It is used as food supplements. A number of pollen products in the form of tablets and syrups are available in the market. It is used to increase the performance of athletes and race horses .

Megasporangium

- Megasporangia arranged on placenta are called ovules.
- The number of ovules in an ovary may be one ---wheat, paddy, mango Many ovules are also seen in ovary---- papaya, water melon, orchids.

Structure of the megasporangium (Ovule)

- The ovule is a small structure attached to the placenta by means of a stalk called funicle.
- The body of the ovule fuses with funicle in the region called hilum.
- Hilum represents the junction between ovule and funicle.
- Each ovule has one or two protective envelopes called integuments.
- Integuments encircle the ovule except at the tip where a small opening called the micropyle is organized.
- Opposite end of the micropylar is called the chalaza and it represents basal part of the ovule.
- A mass of cells enclosed within the integuments is called the nucellus
- It has abundant reserve food materials
- embryo sac or female gametophyte is located in the cells of the nucellus
- An ovule generally has a single embryo sac formed from a megasporangium through reduction division.

Megasporogenesis :

- The process of formation of megasporangium from the megasporangium mother cell is called megasporogenesis.
- Ovules generally differentiate a single megasporangium mother cell (MMC) in the micropylar region of the nucellus.

- MMC is a large cell containing dense cytoplasm and a prominent nucleus.
- The MMC undergoes meiotic division and results in the production of four megasporangia. Development of female gametophyte :
- The MMC undergoes meiotic division and results in the production of four megasporangia
- One of the megasporangia is functional while the other three degenerate
- Functional megasporangium develops into the female gametophyte (embryosac).
- The development of embryo sac from a single megasporangium is termed monosporic development.
- The nucleus of the functional megasporangium divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac.
- Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac
- Mitotic divisions are strictly free nuclear, that is, nuclear divisions are not followed immediately by cell wall formation.
- After the 8-nucleate stage, cell walls are laid down to form female gametophyte or embryo sac.
- Six of the eight nuclei are surrounded by cell walls and organized into cells.
- The remaining two nuclei, called polar nuclei are situated below the egg apparatus in the large central cell.
- Three cells are grouped together at the micropylar end and constitute the egg apparatus and this consists of two synergids and one egg cell.
- The synergids have special cellular thickenings at the micropylar tip called filiform apparatus and it guides the pollen tubes into the synergid.
- Three cells at the chalazal end and are called the antipodal cells.
- The large central cell, has two polar nuclei.
- Angiosperm embryo sac, at maturity, is 7 celled with 8 nuclei.

Pollination

Transfer of pollen grains from the anther to the stigma of a pistil is termed pollination.

Kinds of Pollination: Depending on the source of pollen, pollination can be divided into three types- Autogamy, Geitonogamy, Xenogamy

- (i) **Autogamy:** In this type, pollination is achieved within the same flower. Transfer of pollen grains from the anther to the stigma of the same flower .
 - Some plants produce two types of flowers .Example Viola, Oxalis, and Commelina
 - Chasmogamous flowers have exposed anthers and stigma.
 - cleistogamous flowers which do not open at all. In such flowers, the anthers and stigma lie close to each other. so they are invariably autogamous Plant
- (ii) **Geitonogamy** – Transfer of pollen grains from the anther to the stigma of another flower of the same plant. It is functionally cross-pollination, but genetically it is similar to autogamy since the pollen grains come from the same plant.
- (iii) **Xenogamy** – Transfer of pollen grains from anther to the stigma of a different plant .

Agents of Pollination: Abiotic (wind and water) and one biotic (animals)

Features in Wind pollinated flowers

- The pollen grains are light and non-sticky so that they can be transported in wind currents.
- They often possess well-exposed stamens
- They have large often-feathery stigma to easily trap air-borne pollen grains.
- Wind pollinated flowers have numerous flowers packed into an inflorescence. example -the corn
- Wind-pollination is quite common in grasses.

Features in Water pollinated flowers

- Examples -algae, bryophytes and pteridophytes.
- Examples of water pollinated angiospermic plants - Vallisneria and Hydrilla Zostera.
- In water hyacinth and water lily, the flowers emerge above the level of water and are pollinated by insects or wind.
- In Vallisneria, the female flower reach the surface of water by the long stalk and the male flowers or pollen grains are released on to the surface of water.
- They are carried passively by water currents

Features in sea grasses

- Female flowers remain submerged in water and the pollen grains are released inside the water.
- Pollen grains are long, ribbon like and they are carried passively inside the water
- Pollen grains are protected from wetting by a mucilaginous covering.
- Some of them reach the stigma and achieve pollination.

Biotic agents for pollination

- Bees, butterflies, flies, beetles, wasps, ants, moths, sunbirds and humming birds and bats are the common pollinating agents.
- Insects, particularly bees are the dominant biotic pollinating agents.
- Even larger animals such as lemurs, arboreal rodents, gecko lizard and garden lizard.

Features in insect pollinated flowers

- Flowers are large, colorful, fragrant and rich in nectar.
- When the flowers are small, a number of flowers are clustered into an inflorescence.
- The flowers pollinated by flies and beetles secrete foul odours to attract these animals. Nectar and pollen grains are the usual floral rewards.
- In some species floral rewards are in providing safe places to lay eggs Example -the tallest flower of Amorphophallus
- A similar relationship exists between a species of moth and the plant Yucca where both species – moth and plant – cannot complete their life cycles without each other.
- The moth deposits its eggs in the locule of the ovary and the flower, in turn, gets pollinated by the moth. The larvae of the moth come out of the eggs as the seeds start developing.

Pollen robbers - Many insects may consume pollen or the nectar without bringing about pollination. Such floral visitors are referred to as pollen/nectar robbers.

Outbreeding Devices to discourage self-pollination :

- Continued self-pollination result in inbreeding depression.
- Flowering plants have developed many devices to discourage self-pollination and to encourage cross-pollination.
 - In some species, pollen release and stigma receptivity are not synchronized. Either the pollen is released before the stigma becomes receptive or stigma becomes receptive much before the release of pollen.
 - In some other species, the anther and stigma are placed at different positions so that the pollen cannot come in contact with the stigma of the same flower. These devices prevent autogamy
 - The third device to prevent inbreeding is self-incompatibility. This is a genetic mechanism and prevents self-pollen or pollen from other flowers of the same plant from fertilising the ovules by inhibiting pollen germination or pollen tube growth in the pistil.
 - Another device to prevent self-pollination is the production of unisexual flowers.

Monoecious :--- If both male and female flowers are present on the same plant such as castor and maize it is called monoecious, it prevents autogamy but not geitonogamy

Dioecious:- In several species such as papaya, male and female flowers are present on different plants. This condition is called dioecious

Pollen-pistil Interaction :

- The pistil has the ability to recognise the pollen, whether it is of the right type (compatible) or of the wrong type (incompatible).
- The ability of the pistil to recognize the pollen followed by its acceptance or rejection is due to the continuous dialogue between pollen grain and the pistil.
- This dialogue is mediated by chemical components of the pollen interacting with those of the pistil.
- Following compatible pollination, the pollen grain germinates on the stigma to produce a pollen tube through one of the germ pores.
- The contents of the pollen grain move into the pollen tube.
- Pollen tube grows through the tissues of the stigma and style and reaches the ovary pollen grains are shed at two-celled condition with a vegetative cell and a generate cell.
- In such plants, the generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma.
- Pollen tubes carry the two male gametes from the beginning.
- Pollen tube, after reaching the ovary, enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus
- All these events—from pollen deposition on the stigma until pollen tubes enter the ovule—are together referred to as pollen-pistil interaction.

Artificial hybridisation

- It is one of the major approaches of crop improvement
- In this programmes only the desired pollen grains are used for pollination and the stigma is protected from unwanted pollen.
- This is achieved by emasculation and bagging techniques.
- Removal of anthers from bisexual flowers by using a pair of forceps is called emasculation.
- Emasculated flowers have to be covered with a bag of suitable size, generally made up of butter paper, to prevent contamination of its stigma with unwanted pollen. This process is called bagging.
- When the stigma of bagged flower attains receptivity, mature pollen grains collected from anthers of the male parent are dusted on the stigma, and the flowers are rebagged, and the fruits are allowed to develop.
- If the female parent produces unisexual flowers, the female flower buds are bagged before the flowers open.
- When the stigma becomes receptive, pollination is carried out using the desired pollen and the flower rebagged.

Post-fertilisation events.

- Following double fertilisation, events of endosperm and embryo development, maturation of ovule into seed and ovary into fruit, are collectively termed post-fertilisation events.

Endosperm development

- Endosperm development precedes embryo development.
- The primary endosperm cell divides repeatedly and forms a triploid Primary Endosperm Nucleus (PEN);
- After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid.
- One of the male gamete moves towards the egg cell and fuses with its nucleus thus completing the syngamy.
- This results in the formation of a diploid cell, the zygote.
- The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus
- As this involves the fusion of three haploid nuclei it is termed triple fusion.
- Since two types of fusions, syngamy and triple fusion take place in an embryo sac, the phenomenon is termed double fertilization
- The central cell after triple fusion becomes the primary endosperm cell (PEC) and develops into the endosperm while the zygote develops into an embryo.
- The cells of endosperm tissue are filled with reserve food materials and are used for the nutrition of the developing embryo.
- In the most common type of endosperm development, the PEN undergoes successive nuclear divisions to give rise to free nuclei.
- This stage of endosperm development is called free-nuclear endosperm.
- Subsequently cell wall formation occurs and the endosperm becomes cellular.

Embryo development (embryogeny)

- Embryo develops at the micropylar end of the embryo sac where the zygote is situated.
- Most of the zygotes divide only after certain amount of endosperm is formed and this is to provide assured nutrition to the developing embryo.
- The zygote undergoes division and gives rise to the proembryo , globular, heart-shaped and mature embryo.

Structure of dicotyledonous embryo

- A typical dicotyledonous embryo consists of an embryonal axis and two cotyledons.
- The portion of embryonal axis above the level of cotyledons is the epicotyl that terminates with the plumule or stem tip.
- The cylindrical portion below the level of cotyledons is hypocotyl that terminates with radical or root tip.
- The root tip is covered with a root cap.

Structure of monocotyledons embryo

- Embryos of monocotyledons possess only one cotyledon.
- The cotyledon called scutellum is situated towards one side of the embryonal axis.
- At its lower end, the embryonal axis has the radical and root cap enclosed in an undifferentiated sheath called coleorrhiza.
- The portion of the embryonal axis above the level of attachment of scutellum is the epicotyl.
- Epicotyl has a shoot apex and a few leaf primordia enclosed in a hollow foliar structure, the coleoptile.

Seed

- The seed is the final product of sexual reproduction. It is a fertilised ovule.
- Seeds are formed inside fruits.
- A seed typically consists of seed coat(s), cotyledon(s) and an embryo axis.
- Integuments of ovules harden as tough protective seed coats
- The micropyle remains as a small pore in the seed coat.
- This facilitates entry of oxygen and water into the seed during germination.
- Different types of Seeds
 - Mature seeds may be non-albuminous or albuminous.
 - Non-albuminous seeds have no residual endosperm as it is completely consumed during embryo development Example pea, groundnut.
 - Albuminous seeds retain a part of endosperm as it is not completely used up during embryo development
 - e.g., wheat, maize, barley, castor, sunflower
- In some seeds such as black pepper and beet, remnants of nucellus are also persistent. This residual, persistent nucellus is the perisperm.
- As the seed matures, its water content is reduced and seeds become relatively dry (10-15 per cent moisture by mass).

- The general metabolic activity of the embryo slows down and the embryo may enter into a state of inactivity called dormancy, or if favorable conditions are available they germinate.
- The oldest seed is that of a lupine, *Lupinus arcticus* excavated from Arctic Tundra.

Importance of seeds

- Firstly, since reproductive processes such as pollination and fertilization are independent of water, seed formation is more dependable.
- Also seeds have better adaptive strategies for dispersal to new habitats and help the species to colonise in other areas.
- As they have sufficient food reserves, young seedlings are nourished until they are capable of photosynthesis on their own.
- The hard seed coat provides protection to the young embryo.
- It is the product of fertilization and thus they generate new genetic combinations that lead to variations.
- To the mankind, the seed is the primary source of food and they can be stored .
- Seed is the basis of our agriculture

Fruits

- The ovary develops into a fruit.
- The wall of the ovary develops into the wall of fruit called pericarp.
- The fruits may be fleshy as in guava, orange, mango, etc., or may be dry, as in groundnut, and mustard.
- In a few species such as apple, strawberry, cashew, etc., the thalamus also contributes to fruit formation. Such fruits are called false fruits
- Most of the fruits develop only from the ovary and are called true fruits. Fruits are the results of fertilisation,
- But in some species fruits develop without fertilisation and are called parthenocarpic fruits. Banana is one such example, such fruits are seedless.

Apomixis

- A special mechanism that produces seeds without fertilization is called apomixis.
- Development of embryos without the act of fertilization from normal diploid cells is called apomixes.
- It is found particularly in grasses
- Thus, apomixis is a form of asexual reproduction that mimics sexual reproduction.
- These embryos are developed in the following ways.
- In some species, the diploid egg cell is formed without reduction division and develops into the embryo without fertilisation.
- In some varieties, some of the nucellar cells surrounding the embryo sac start dividing, protrude into the embryo sac and develop into the embryos.
- In such species each ovule contains many embryos.
- More than one embryo in a seed is referred as polyembryony.
- Apomicts have several advantages in horticulture and agriculture.
- If these hybrids are made into apomicts, there is no segregation of characters in the hybrid progeny.

- Then the farmers can keep on using the hybrid seeds to raise new crop year after year.

Disadvantages of using hybrid varieties

- One of the problems of hybrids is that hybrid seeds have to be produced every year.
- If the seeds collected from hybrids are sown, the plants in the progeny will segregate and do not maintain hybrid characters.
- Production of hybrid seeds is costly and hence the cost of hybrid seeds becomes too expensive for the farmers.

CHAPTER 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS

1 MARK QUESTIONS-MCQ's

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

- a. Plant is dioecious and bears only pistillate flowers
 - b. Plant is dioecious and bears both pistillate and staminate flowers
 - c. Plant is monoecious
 - d. Plant is dioecious and bears only staminate flowers.
5. The outermost and innermost wall layers of microsporangium in an anther are respectively:
- a. Endothecium and tapetum
 - b. Epidermis and endodermis
 - c. Epidermis and middle layer
 - d. Epidermis and tapetum
6. Which of the following fruit is produced by parthenocarpy?
- a. Brinjal
 - b. Apple
 - c. Banana
 - d. Jackfruit
7. The process of formation of seeds without fertilization in flowering plants is known as
- a. Budding
 - b. Apomixis
 - c. Sporulation
 - d. Somatic hybridization
8. Functional megasporangium in an angiosperm develops into
- a. Endosperm
 - b. Embryo
 - c. Embryo-sac
 - d. Ovule
9. Rewards and attractants are required for
- a. Entomophily
 - b. Cleistogamy
 - c. Anemophily
 - d. Hydrophily
10. A dioecious flowering plant prevents
- a. Geitonogamy and xenogamy
 - b. Autogamy and xenogamy
 - c. Autogamy and geitonogamy
 - d. Cleistogamy and xenogamy

Assertion Reason Questions

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

- 1.** **Assertion:** Red colour of flowers attracts butterflies and wasps, but not bees.

Reason: Bees are colour-blind to red.

- 2.** **Assertion:** Cross pollination results in healthy and stronger offspring.

Reason: Due to phenomenon of hybrid vigour.

- 3.** **Assertion :** Autogamy is a transfer of pollen grains from an anther to the stigma of the same flower on the same plant.

Reason : Xenogamy is pollination between two flowers on different plants.

- 4.** **Assertion :** Insects visit flower to gather honey.

Reason : Attraction of flowers prevents the insects from damaging other parts of the plant.

- 5.** **Assertion :** Pollen mother cells (PMCs) are the first male gametophytic cells.

Reason : Each PMC gives rise to two pollens.

Case study

Read the following and answer any four questions from (i) to (v) given below:

Hybrid seeds created by crossing two varieties have superior qualities including high yield, pest resistance and climate tolerance and have been used by farmers for decades. In a breakthrough for farmers across the world, especially those from developing countries, scientists have discovered a way to clone hybrid seeds of rice.

So, farmers have had no option but to buy expensive hybrid seeds every year. Asexual reproduction through seeds, called Apomixis, is known to occur naturally in more than 400 species of wild plants, but not in crops. The embryos can develop directly from a diploid egg or the nucellus in the ovule without fertilisation. This mechanism of seed production allows a plant to clone itself through a seed, without fertilization and, thus prevents any loss of hybrid characters in plants. However, recreating these pathways in crop plants has been a challenge to science.

- i. Which part of the flower form seeds?

- ii. There will be variations among the off springs of a plant which undergoes

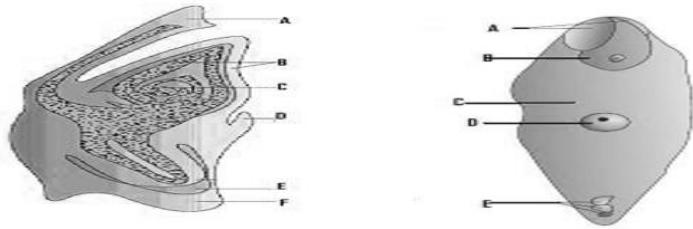
- iii. What is the ploidy of nucellus that undergoes apomixis?
- iv. What are the problems with hybrid seeds?

2 MARK QUESTIONS

2. Give the ploidy of-
 - a) Nucellus b) MMC
 - c) Functional megasporangium d) Female gametophyte
3. Research is ongoing to transfer apomictic genes into hybrid varieties. Why?
4. Give the two processes crucial for storage of seeds. Also state why?
5. Draw the three-dimensional cut section of an anther and label it.
6. Among the animal, insects particularly bees are the dominant pollinating agents. List any four characteristic features of the insect pollinated flower.
7. An anther with malfunctioning tapetum often fails to produce viable male gametophytes. Give one reason.
8. “Incompatibility is a natural barrier in the fusion of gametes” Justify
9. If you squeeze a seed of orange, you might observe many embryos of different sizes. How is it possible? Explain.
10. A pure tall pistillate plant (TT) is crossed with a pure dwarf staminate plant (tt). What would be the genotype and ploidy level of?
 - (a) Endosperm
 - (b) Microspore mother cell.
10. The following statements(i), (ii) and (iii) seem to describe the water-pollinated submerged plants. Which one of these statements is incorrect?
 - a) The flowers do not produce nectar.
 - b) The pollen grains have mucilaginous covering.
 - c) The brightly coloured female flowers have long stalk to reach the surface.

THREE-MARK QUESTIONS

1. How do emasculation and bagging help in artificial hybridization?
- 2.a) What is intine made of?
 - b) Give the function of generative cell.
 - c) Exine has some prominent aperture. Name them and give their function.
3. Draw a neatly labelled diagram of an anatropous ovule (with embryo sac). Label the following parts in it.
 - (a) The place from where the pollen tube enters in ovule.
 - (b) Basal part of the ovule
 - (c) Inner protective covering
4. Label the following figures:



5. Presently, cultivation of hybrid varieties of our food and vegetable crops has increased due to their higher productivity. Still, many of the farmers are not cultivating because of some problems:
- Mention any two problems associated with sowing of the seeds of the hybrid varieties of the crops
 - How can we overcome such problems?
6. Give reasons why
- Most zygote in angiosperms divide only after certain amount of endosperm is formed
 - Groundnut seeds are ex-aluminous and castor seeds are aluminous.
 - Micropyle remain as a small pore in the seed coat of a seed?

FIVE-MARK QUESTIONS

- a) What is self-incompatibility?
b) Why does self-pollination not lead to seed formation in self-incompatible species?
c) How does this process help the phenomenon of evolution?
 - Differentiate between the following with one example each-
 - Syncarpous and Apocarpous ovary
 - Synergids and antipodal cells
 - PMC and MMC
 - What happens to the various flower whorls once fertilization takes place?
 - Draw the stages of microspore maturing into pollen grain. Explain each one of them.
 - What will be the fate of following structures in the angiospermic plant?
Ovary wall, Ovule, zygote, outer integument Inner integument and primary endosperm nucleus.
 - Draw the embryo sac of a flowering plants and label:
 - (i) Central Cell (ii) Chalazal end (iii) Synergids
 - Name the cell that develops into embryo sac and explain how this cell leads to formation of embryo sac.
 - Mention the role played by various cells of embryo sac.
 - Give the role of filiform apparatus
 - Draw a labelled diagram of L.S. of an embryo of grass (any six labels) and answer the following questions giving suitable reasons
 - Anther of angiosperm flowers are described as dithecos
 - Hybrid seeds have to be produced year after year.
-

CHAPTER 3 **HUMAN REPRODUCTION**

SYNOPSIS

The reproductive events in humans

- **Gametogenesis:** -formation of gametes
- **Insemination:** transfer of sperms into the female genital tract.
- **Fertilization:** - fusion of male and female gametes (fertilisation) leading to formation of zygote.
- This is followed by formation and development of blastocyst
- Implantation is its attachment to the uterine wall (implantation), embryonic development (gestation) and delivery of the baby (parturition).

The male reproductive system is located in the pelvis region

- It includes a pair of testes along with accessory ducts, glands and the external genitalia.
- The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes

Structure of testis

- The testis is covered by a dense covering. Each testis has about 250 compartments called testicular lobules and each lobule contains one to three highly coiled seminiferous tubules in which sperms are produced. Each seminiferous tubule has two types of cells called male germ cells and Sertoli cells.
- The male germ cells form sperm, while Sertoli cells provide nutrition to the germ cells.
- The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells and they synthesise and secrete testicular hormones called androgens.

The male sex accessory ducts :

- This includes rete testis, vasa efferentia, epididymis and vas deferens.
- The seminiferous tubules of the testis open into the vasa efferentia
- The vasa efferentia open into epididymis
- The epididymis leads to vas deferens that ascends to the abdomen and loops over the urinary bladder.
- It receives a duct from seminal vesicle and opens into urethra as the ejaculatory duct.
- These ducts store and transport the sperms from the testis to the outside through urethra. The male accessory glands
- This includes paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium.

The female reproductive system

- The female reproductive system consists of a pair of ovaries, a pair of oviducts, uterus, cervix, vagina and the external genitalia located in pelvic region.
- These parts of the system along with a pair of the mammary glands are integrated structurally and functionally to support the processes of ovulation, fertilisation, pregnancy, birth and child care.

- Ovaries are the primary female sex organs that produce ovum or eggs.

Female accessory ducts

- The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts.
- Each fallopian tube is about 10-12 cm long and it has parts like infundibulum.
- fimbriae, ampulla., isthmus has a narrow lumen and it joins the uterus.
- The uterus is single and it is also called womb.
- The uterus opens into vagina through a narrow cervix.
- The cavity of the cervix is called cervical canal which along with vagina forms the birth canal.
- The wall of the uterus has three layers perimetrium, myometrium and endometrium that lines the uterine cavity.

The female external genitalia

- The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris.

Mammary glands

- The mammary glands are paired structures (breasts) that contain glandular tissue and variable amount of fat.
- The glandular tissue is divided into 15-20 mammary lobes
- It contain clusters of cells called alveoli and it open into mammary tubules.
- And The cells of alveoli secrete milk,
- The tubules of each lobe join to form a mammary duct.
- Several mammary ducts join to form a wider mammary ampulla which is connected to lactiferous duct.
- **Gametogenesis.**- The primary sex organs – the testis in the males – produce gametes sperms and the ovaries in the Females produce ovum by the process called gametogenesis.

Spermatogenesis :-

- In testis, the immature male germ cells (spermatogonia) produce sperms and begins at puberty.
- Each spermatogonium is diploid and contains 46 chromosomes.
- The spermatogonia multiply by mitotic division and increase in numbers.
- Some of the spermatogonia called primary spermatocytes undergo meiosis.
- A primary spermatocyte completes the first meiotic division (reduction division) leading to formation of two equal, haploid cells called secondary spermatocytes
- The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids and the spermatids are transformed into spermatozoa (sperms) by the process called spermiogenesis.

- After spermiogenesis sperm heads become embedded in the Sertoli cells, and are finally released from the seminiferous tubules by the process called spermiation.

Hormonal action on spermatogenesis

- Spermatogenesis starts at the age of puberty due to significant increase in the secretion of gonadotropin releasing hormone
- The increased levels of GnRH acts at the anterior pituitary gland and stimulates secretion of two gonadotropins – luteinising hormone (LH) and follicle stimulating hormone (FSH).
- LH acts at the Leydig cells and stimulates synthesis and secretion of androgens and it stimulate them process of spermatogenesis.
- FSH acts on the Sertoli cells and stimulates secretion of some factors which help in the process of spermiogenesis.

The structure of a sperm

- It is a microscopic structure composed of a head, neck, a middle piece and a tail and acrosome and it is motile
- Semen :Secretions of epididymis, vas deferens, seminal vesicle and prostate are essential for maturation and motility of sperms. The seminal plasma along with the sperms constitute the semen.

Oogenesis:

- It is the process of formation of a mature female gamete
- Oogenesis is initiated during the embryonic development stage .
- No more oogonia are formed and added after birth.
- These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage,it is called primary oocytes.
- Each primary oocyte then gets surrounded by a layer of granulosa cells and form the primary follicle
- Later the primary follicles get surrounded by more layers of granulosa cells and a new theca and called secondary follicles.
- The secondary follicle soon transforms into a tertiary follicle which is characterised by a fluid filled cavity called antrum.
- The primary oocyte within the tertiary follicle grows in size and completes its first meiotic division.
- It is an unequal division resulting in the formation of a large haploid secondary oocyte and a tiny first polar body..
- The tertiary follicle further changes into the mature follicle or Graafian follicle
- The Graafian follicle now ruptures to release the secondary oocyte (ovum) from the ovary by the process called ovulation.

Menstrual cycle :The reproductive cycle in the female primates (e.g. monkeys, apes and human beings) is called menstrual cycle and the cycle of events starting from one menstruation till the next one is called the menstrual cycle. One ovum is released (ovulation) during the middle.

Menarche: -The first menstruation begins at puberty and is called Menarche.

Major events in Menstrual cycle

- The cycle starts with the menstrual phase, when menstrual flow occurs and it lasts for 3-5 days. The menstrual flow results due to breakdown of endometrial lining of the uterus and its blood vessels which forms liquid that comes out through vagina.
- The menstrual phase is followed by the follicular phase.
- During this phase, the primary follicles in the ovary grow to become a fully mature Graafian follicle and endometrium regenerates through proliferation.
- These changes are induced by gonadotropins (LH and FSH),
- This stimulates follicular development as well as secretion of estrogens by the growing follicles
- Rapid secretion of LH leading to its maximum level during the mid-cycle called LH surge and it induces rupture of Graafian follicle and thereby the release of ovum called (ovulation).
- Ovulatory phase is followed by the luteal phase during which the remaining parts of the Graafian follicle transform as the corpus luteum
- The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium.
- In the absence of fertilisation, the corpus luteum degenerates. This causes disintegration of the endometrium leading to menstruation, marking a new cycle.
- In human beings, menstrual cycles ceases around 50 years of age; that is termed as menopause.

Fertilisation

- The process of fusion of a sperm with an ovum is called fertilisation.
- Ovum surrounded by few sperms and this induces the completion of the meiotic division of the secondary oocyte. Results in the formation of a second polar body and a haploid ovum (oovid). Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote.
- The mitotic division starts as the zygote moves through the isthmus of the oviduct and forms 2, 4, 8, 16 daughter cells called blastomeres.
- The embryo with 8 to 16 blastomeres is called a morula .
- The morula continues to divide and transforms into blastocyst as it moves further into the uterus.
- The blastomeres in the blastocyst are arranged into an outer layer called trophoblast and an inner group of cells attached to trophoblast called the inner cell mass.
- The trophoblast layer then gets attached to the endometrium and the inner cell mass gets differentiated as the embryo. .

- As a result, the blastocyst becomes embedded in the endometrium of the uterus. This is called implantation and it leads to pregnancy.

Embryonic development

- After implantation, finger-like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood.
- The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between
- developing foetus and maternal body called placenta
- The placenta facilitate the supply of oxygen and nutrients to the embryo and also removal of carbon dioxide and excretory/waste materials produced by the embryo.
- The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. Placenta also acts as an endocrine tissue and produces several hormones.
- Immediately after implantation, the inner cell mass (embryo) differentiates into an outer layer called ectoderm and an inner layer called endoderm. A mesoderm soon appears between the ectoderm and the endoderm.
- These three layers give rise to all tissues (organs) in adults.
- The inner cell mass contains certain cells called stem cells which have the potency to give rise to all the tissues and organs.
- Gestation period :**The average duration of human pregnancy is about 9 months which is called the gestation period.
- Parturition:** Vigorous contraction of the uterus at the end of pregnancy causes expulsion/delivery of the foetus. This process of delivery of the foetus (childbirth) is called parturition.
- Parturition is induced by a complex neuroendocrine mechanism.
- The signals for parturition originate from the fully developed fetus and the placenta and it induces mild uterine contractions called foetal ejection reflex.
- This triggers release of oxytocin and it acts on the uterine muscle and causes stronger uterine contractions and this leads to expulsion of the baby out of the uterus through the birth canal.

Lactation: The mammary glands of the female undergo differentiation during pregnancy and starts producing milk towards the end of pregnancy by the process called lactation. The milk produced during the initial few days of lactation is called colostrum which contains several antibodies absolutely essential to develop resistance for the new-born babies.

CHAPTER 3

HUMAN REPRODUCTION

1 MARK QUESTIONS-MCQ's

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

(a) i and ii
(b) i, ii and iv
(c) ii, iii and iv
(d) i and iv
5. Spermiation is the process of the release of sperms from:
 - a. Seminiferous tubules
 - b. Vas deferens
 - c. Epididymis
 - d. Prostate gland

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

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

Assertion Reason Questions

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

1. Assertion-The uterus is shaped like an inverted pear.

Reason- The inner glandular layer lining the uterine cavity is called as myometrium.

2. Assertion-The middle piece of the sperm is called its powerhouse.

Reason- Numerous mitochondria in the middle piece produce energy for the movement of the tail.

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

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

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

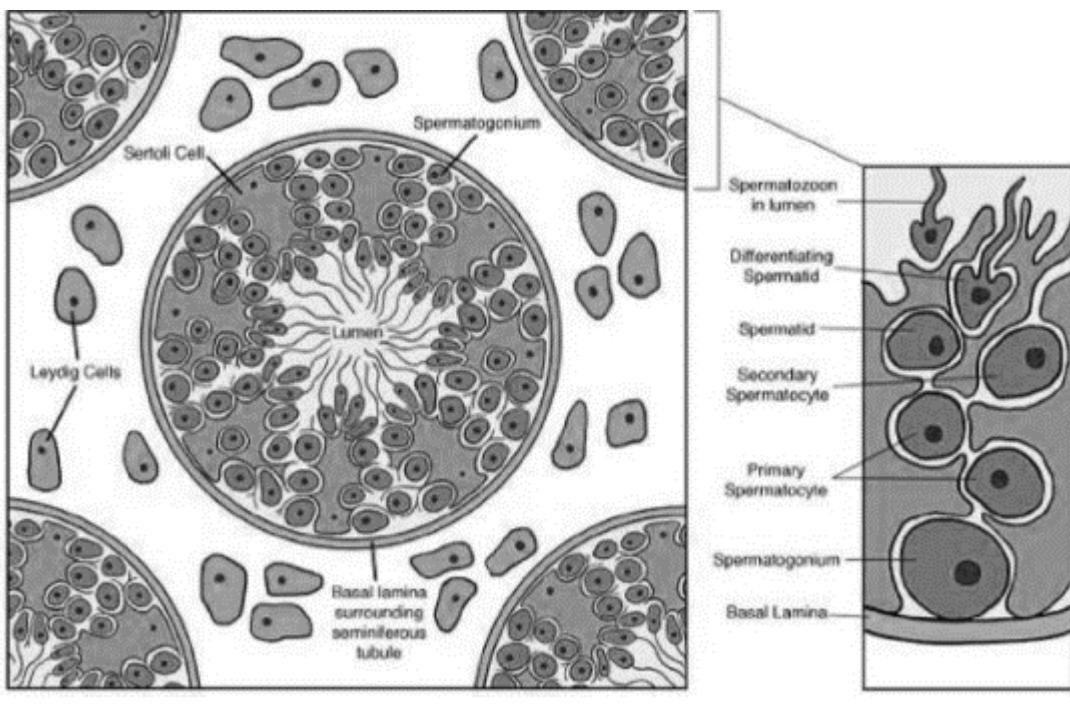
Reason : These lobules are involved in the process of fertilization.

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

Reason : Interstitial cells provide nutrition to the Sertoli cells.

CASE -BASED- QUESTION

Q. Study the figure given and answer the questions that follows: (answer any four) 1x4

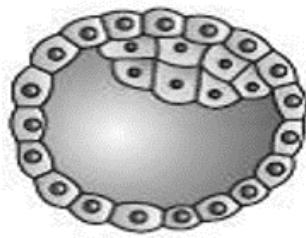


- i) What is the function of Sertoli cells?
- ii) List any four parts that a Cross section of testes shows

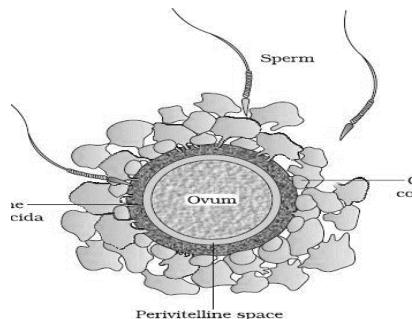
- iii) Pick out and name the cells that undergo spermiogenesis.
- iv) How many sperms will be produced from 50 primary spermatocytes?
- v) Testosterone is secreted which cell?

2 MARK QUESTIONS

1. Give the ploidy of-
 - a) Sertoli cells b) Spermatid
 - c) Corpus luteum d) Ovum
2. Name the male sex accessory ducts.
3. Name the three layers of tissue in uterine wall.
4. In which part of the female reproductive system do the following events occur.
 - (a) Release of 1st polar body (b) Release of 2nd polar body.
 - (c) Fertilization (d) Formation of corpus albican
5. Identify the given stages of reproduction/development of embryo shown and mention where would these occur in the female reproductive tract .



6. Look at the given figure of a mammalian ovum surrounded by sperms.



- a) Differentiate between ootid and spermatid.
- b) Complete the table:

SPERM	OVUM	ZYGOTE	SEX OF CHILD
X	X		

Y

X

c) Give the percentage of sperms – a) having normal shape and size b) vigorous motility for normal fertility?

d) Name the hormones produced by placenta.

7. Schematically depict human oogenesis till fetal life. Specify number of chromosomes.

8. Where are the Leydig cells present in testis? What is the function of Leydig cells?

9. If a spermatogonia cell has 30 chromosomes, what will be the number of chromosomes in

- i) The primary spermatocyte
- ii) The spermatids derived from this cell

iii) How many spermatids are produced from one primary spermatocyte?

10. What are the main structural constituents of mammary glands?

11. How does a spermatocyte differ from an oocyte?

12. Once a sperm fertilizes a ovum, other sperms are not able to enter it. How is this accomplished?

13.. 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

14.. i) Name the procedure of rupture of Graffian follicle and subsequent release of the egg from the ovary.

ii) What is secreted by corpus luteum

15. Mention the target cells of LH in human males and females. Explain the effect and the changes which the hormone induces in each case

3 MARK QUESTIONS

1. Draw the diagrammatic section of seminiferous tubule. Label it.

2. a) Identify the given stages of reproduction/development of embryo shown and mention where would these occur in the female reproductive tract?

i. 16 celled stage ii. More than 32 celled stage with a blastocoel.

b) How does implantation occur in the uterus?

3. Differentiate between Follicular phase and Luteal phase.

4. What is foetal ejection reflex? From where does it originate and what are its effects?

5. Give the location and function of –

a) Seminal vesicles

b) Bulbourethral gland

6. Explain the following

i) Failure of testis to descend into the scrotum produces sterility

ii) Spermatids possess a haploid chromosome number

iii) Primary sex organ control growth and maintenance of secondary sex organs.

7. Distinguish between

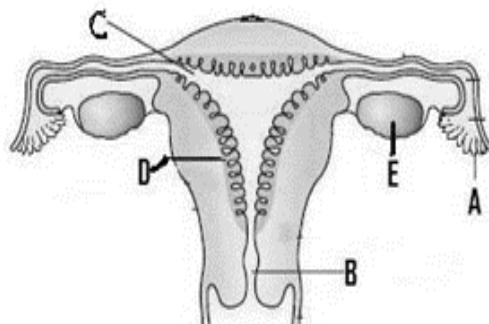
i) spermiogenesis and spermiation

ii) Proliferative and secretory phases of menstrual cycle

iv) Vas deferentia and Vas efferentia

5-MARK QUESTIONS

1. What are the major features of embryonic development in various months of pregnancy?
2. 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 fetus and placenta.
 - (b) _____.
 - (c) _____.
 - (d) Oxytocin causes strong uterine contraction
 - (e) Uterine contraction stimulates further secretion of oxytocin.
 - (f) _____.
3. a) Diagrammatically depict the human male reproductive structure and label the following: Testis, fore skin, Ejaculatory duct, vas deferens and urethra.
b) State the function of each.
4. Depict spermatogenesis schematically and elucidate the ploidy at each stage.
5. 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.
6. Explain the various events taking place during menstrual cycle. Depict diagrammatically ovarian events and graphic depiction of hormone levels.
7. Label A, B, C, D and E. Give the function of each:



8. Give the term / reason:

- a.
 1. Mechanism responsible for parturition.
 2. Role of oxytocin during expulsion of the baby out of uterus
 3. Why does zona pellucida layer block the entry of additional sperms?

4. Sperm cannot reach ovum without seminal plasma.
 5. All copulations do not lead to fertilization and pregnancy.
-

SYNOPSIS
CHAPTER 4
REPRODUCTIVE HEALTH

- Reproductive Health: Reproductive health refers to a total well-being in all aspects of reproduction, i.e., physical, emotional, behavioral and social.

(RCH) programmes

- ‘Reproductive and Child Health Care (RCH) programmes’.

Objectives

- Creating awareness among people about various reproduction related aspects and providing facilities and support for building up a reproductively healthy society
- Audio-visual , the print-media governmental and non-governmental agencies helped to create awareness among the people about reproduction-related aspects

Steps that help adolescent to lead reproductively health life

- Introduction of sex education in schools to provide right information to the young so as to discourage children from believing in myths and having misconceptions about sex-related aspects.
- Provide proper information about reproductive organs, adolescence and related changes, safe and hygienic sexual practices, sexually transmitted diseases (STD), AIDS,

Socially conscious healthy families of desired size.

- Educating fertile couples and those in marriageable age group, about available birth control options, care of pregnant mothers, post-natal care of the mother and child, importance of breast feeding, equal opportunities for the male and the female child.

Building up of socially responsible and healthy society.

- Create awareness of problems due to uncontrolled population growth, social evils like sex-abuse and sex-related crimes.
- Amniocentesis : a fetal sex determination test based on the chromosomal pattern in the amniotic fluid surrounding the developing embryo for sex-determination .
- CDRI:-Central Drug Research Institute (CDRI) in Luck now.

Factors that indicate improved reproductive health of the society.

- Better awareness about sex related matters.
- Increased number of medically assisted deliveries
- Better post-natal care leading to decreased maternal and infant mortality rates
- Increased number of couples with small families, better detection and cure of STDs and overall increased medical facilities for all sex-related problems,

Reasons for population explosion in India

- An overall improvement in reproductive health in our country
- A rapid decline in death rate, maternal mortality rate (MMR) and infant mortality rate (IMR) ,
- An increase in number of people in reproducible age. early detection and cure of STDs, assistance to infertile couples,
- Improved health facilities and Better living conditions promoted an explosive growth of population

Serious measures taken by government to check this population growth rate

- Motivated people to have smaller families by using various contraceptive.
- Statutory raising of marriageable age of the female to 18 years and that of males to 21 years,
- Incentives given to couples with small families

Features of ideal contraceptive

- An ideal contraceptive should be user-friendly, easily available, effective and reversible with no or least side-effects.

Different types of contraceptive method

- Natural/Traditional, Barrier, IUDs, Oral contraceptives, Injectables, Implants and Surgical methods.
- Natural methods: This work on the principle of avoiding chances of ovum and sperms meeting.
- Periodic abstinence :-Natural method is one such method in which the couples avoid coitus from day 10 to 17 of the menstrual cycle.
- Withdrawal or coitus interrupts is another method
- Lactational amenorrhea (absence of menstruation) method is based on the fact that ovulation and therefore the cycle do not occur during the period of intense lactation following parturition.

- Barrier Methods
- Ovum and sperms are prevented from physically meeting.
- Condoms ,Diaphragms, cervical caps and vaults are some barriers They prevent conception by blocking the entry of sperms through the cervix.

Effective and popular method: Use of Intra Uterine Devices (IUDs). Non-medicated IUDs ---

Lippes loop),

- Copper releasing IUDs --CuT, Cu7, Multiload 375 Hormone releasing IUDs Progestasert--- LNG-20
- IUDs increase phagocytosis of sperms within the uterus
- The Cu ions released suppress sperm motility and the fertilizing capacity of sperms.
- The hormone releasing IUDs, make the uterus unsuitable for implantation and the cervix hostile to the sperms. IUDs are ideal contraceptives for the females.

Oral contraceptives

- Oral administration of small doses of either progestogens or progestogen–estrogen combinations by the females. They are used in the form of tablets and are popularly called the pills.
- Pills have to be taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle.
- They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/ retard entry of sperms
- They have lesser side effects
- Saheli –oral contraceptive for the females contains a non-steroidal preparation. It is a ‘once a week’ pill with very few side effects and high contraceptive value.

Injections or implants

- Progestogens alone or in combination with estrogen can also be used by females as injections or implants under the skin .

Surgical methods:

- It is also called sterilization.
- Surgical intervention blocks gamete transport and prevent conception.
- Sterilization procedure in the male is called ‘vasectomy’. In vasectomy, a small part of the vas deferens is removed or tied up through a small incision on the scrotum.
- Sterilization procedure in female is called ‘tubectomy’. In tubectomy, a small part of the fallopian tube is removed or tied up through a small incision in the abdomen or through vagina.
- These techniques are highly effective but their reversibility is very poor.

Ill effects of contraceptive methods

- Nausea, abdominal pain, breakthrough bleeding, irregular menstrual bleeding or even breast cancer.

MTP

- Intentional or voluntary termination of pregnancy before full term is called medical termination of pregnancy (MTP) or induced abortion.

- Nearly Government of India legalized MTP in 1971 with some strict conditions to avoid its misuse.
- Such restrictions are done to check indiscriminate and illegal female foeticides
- MTP is generally performed to get rid of unwanted pregnancy due to rapes, casual relationship, in cases when the continuation of pregnancy could be harmful or even fatal to either the mother, or the foetus or both.
- MTPs are considered relatively safe during the first trimester, i.e., up to 12 weeks of pregnancy.
- Dangerous trend related to MTP :-- majority of the MTPs are performed illegally by unqualified quacks
- Another dangerous trend is the misuse of amniocentesis to determine the sex of the unborn child.

SEXUALLY TRANSMITTED DISEASES

- Diseases or infections which are transmitted through sexual intercourse are collectively called sexually transmitted diseases (STD) or venereal diseases (VD) or reproductive tract infections (RTI).
- Examples are Gonorrhoea, syphilis, genital herpes, chlamydia, genital warts, trichomoniasis, hepatitis-B , HIV leading to AIDS

Mode of transmission--

- Hepatitis-B and HIV can be transmitted by sharing of injection needles, surgical instruments, etc., with infected persons, transfusion of blood, or from an infected mother to the foetus .
- Early symptoms:-- itching, fluid discharge, slight pain, swellings, etc., in the genital region.
- Infected females may often be asymptomatic and hence, may remain undetected for long and this could lead to complications like pelvic inflammatory diseases ,abortions, still births, ectopic pregnancies, infertility or even cancer of the reproductive tract.
- Their incidences are reported to be very high among persons in the age group of 15-24 years

Preventive measures for STDs

- (i) Avoid sex with unknown partners/multiple partners.
- (ii) Always use condoms during coitus.
- (iii) In case of doubt, go to a qualified doctor for early detection and get complete treatment if diagnosed with disease.

INFERTILITY

- Inability to conceive or produce children even after 2 years of unprotected sexual cohabitation is called infertility.
- The reasons can be--physical, congenital, diseases, drugs, immunological or even psychological.

Assisted reproductive technologies (ART)

- In vitro fertilisation --IVF--It is the fertilisation outside the body , followed by embryo transfer (ET)
- Ova from the wife/donor (female) and sperms from the husband/donor (male) are collected and are induced to form zygote under simulated conditions in the laboratory

Test Tube Baby' Programme

- In Vitro fertilisation followed by transfer of embryo into the female genital tract is commonly known as the ‘Test Tube Baby’ Programme

Transfer of zygotes

- The zygote or early embryos could then be transferred into the fallopian tube--ZIFT—zygote intra fallopian transfer.
- Embryos with more than 8 blastomeres, could then be transferred into the uterus --IUT – intra uterine transfer, to complete its further development.
- Embryos formed by in-vivo fertilisation (fusion of gametes within the female) also could be used

Transfer of ovum

- GIFT – gamete intra fallopian transfer:-- Transfer of an ovum collected from a donor into the fallopian tube of another female who cannot produce one, but can provide suitable environment for fertilization and further development.
- Intra cytoplasmic sperm injection (ICSI) is a method in which a sperm is directly injected into the ovum.
- Artificial insemination (AI):--. In this technique, the semen collected either from the husband or a healthy donor is artificially introduced either into the vagina or into the uterus (IUI – intra-uterine insemination) of the female.

CHAPTER 4 **REPRODUCTIVE HEALTH**

1 MARK QUESTIONS-MCQ's

1. Which Artificial Reproductive Technique can help a lady conceive a child if both her fallopian tubes are blocked?

- SUZI
- IVF
- ZIFT
- GIFT

2. Which of the following is not a copper releasing IUD?

- LNG 20
- CuT
- Lippes Loop
- a and c

3. Which of the following is the characteristic of an ideal contraceptive?

- a. Irreversible
 - b. Easily available
 - c. User friendly
 - d. Effective with least side effects
4. What is the expansion for MTP?
- a. Medical Termination of Parturition
 - b. Mechanical Transfer of Pollen
 - c. Medical Termination of Pregnancy
 - d. Maternally Transmitted Pathogens
5. Amniocentesis is a process of
- a. Growing cells on culture media
 - b. Know about brain disease
 - c. Determine mutations
 - d. Determine disease of the embryo
6. The function of Copper-T is
- a. Stop gastrulation
 - b. Stop cleavage
 - c. Check mutation
 - d. Stop fertilization
7. What is the shape of the growth curve?
- a. S shaped
 - b. V shaped
 - c. C shaped
 - d. J shaped
8. Which part of the female reproductive system remains blocked after tubectomy?
- a. Fallopian tube
 - b. Oviduct
 - c. Cervix
 - d. Uterine cavity
9. A widely accepted method of contraception in India is
- a. IUDs
 - b. Diaphragms
 - c. Tubectomy
 - d. Cervical caps
10. By which name is family planning currently known as?

- a. Reproductive and child care
- b. Family and child care
- c. Reproductive and child health
- d. Reproductive and child health .

Assertion Reason Questions

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

1. Assertion: Hepatitis B is also considered a sexually transmitted disease.

Reason: It can be spread through sexual contact.

2. Assertion: The term sexually transmitted infection is generally preferred over sexuallytransmitted disease or venereal disease.

Reason: There is often shame and stigma associated with these infections.

3. **Assertion:** A person should be considered reproductively healthy if they have healthy reproductive organs but are emotionally imbalanced.

Reason: This statement about reproductive health was given by WHO.

4. **Assertion:** Family planning is an action plan to attain reproductive health among people.

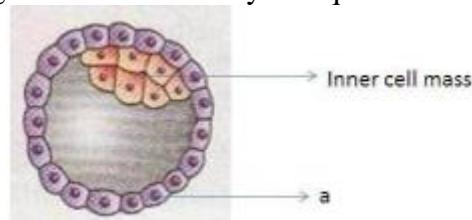
Reason: Improved programmes covering reproduction related areas were propagated by RCH to create awareness among people.

5. **Assertion:** Reproductive and Child Healthcare Programmes is for reproduction related areas.

Reason: It deals with creating awareness among various reproduction related aspects.

CASE STUDY

Study the diagram and answer any fourquestions:1x4



- i) Name the stage of human embryo the figure represents.
- ii) Where are the stem cells located in this embryo?
 - a) Inner cell mass
 - b) Blastocoel

- c) Blastomeres
 - d) Blastocyst
- iii) Write the name of “a”
- iv) Which layer gets attached to the cells of endometrium and name the part which develops into embryo?
- v) How is the placenta connected to the embryo?

2 MARK QUESTIONS

1. Give some simple principles to avoid STDs.
2. What are barrier methods of birth control? Name two of them.
3. What is amniocentesis? How is it performed?
4. ‘HUM DO HUMARE DO’ was a popular family planning slogan of the Indian government. What does it mean? How was it supposed to help in controlling population explosion?
5. What is MMR? What is the recent trend in this ?
6. What are the different types of IUDs. Give examples for each category.
7. After a successful in vitro fertilization, the fertilized egg begins to divide. Where is this egg transferred before it reaches the 8-celled stage and what is this technique called?
8. What are the major tasks taken by RCH programmes?
9. What are implants? How do they help in preventing fertilization?
10. Enlist any four possible reasons for infertility in human beings.
11. If you were a volunteer at RCH how would you counsel a couple to go for barrier method to avoid conception than lactational amenorrhea?
12. A mother of one year old wanted to space her second child. Her doctor suggested her to use the pills called ‘Saheli’. Write two advantages of this pill over the normal ones.

13. If you are a participant in a debate competition on the topic legalization of medical termination of pregnancy, write two points in favor of the topic.
14. In case of an infertile couple, the male partner can inseminate normally but the mobility of sperms is below 40 percent. Judge, which kind of ART is suited in this situation to form an embryo in the laboratory, without involving a donor?

3 MARK QUESTIONS

- 1.What role has Indian Government played in promoting RCH? Elucidate some of the methods used.
- 2.Give the causative agent of-i) Chlamydiosis ii) Syphilis iii) Gonorrhoea

- 3.Infertility is always blamed on the women partner in most societies in the world. Do you agree? Justify your answer.

4. Give the symptoms of STD'S.

5. 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 fertilization 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

6. Explain the following types of contraceptives (i) Natural Methods (ii) Barrier method
Intra uterine devices.

7. What is MTP? Why is it legalized in our country? What are the dangerous trends related to MTP?

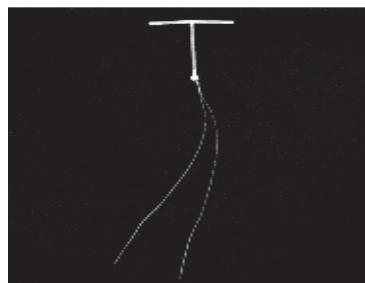
8. The fallopian tubes of a woman are cut and ligated.

- i. What is this method of sterilization called?
- ii. Write how does it prevent conception.
- iii. Write one advantage and limitation of this technique

9. Why is hormone releasing IUD considered a good contraceptive to space children

5 MARK QUESTION

1. a) Observe the following picture and write down its name. -



b) How is it used for contraception?

c) Which category of contraceptives does it come under?

d) Name one non medicated contraceptive of this category?

e) What physiological processes occur due to use of such Contraceptives that prevent pregnancy?

f) These methods are popular amongst women. Why?

2. Many couples suffer from mental traumas as a result of infertility.

What medical procedures could you suggest to them for solving their problems? Explain in detail at least three of them.

3. Surgical methods are terminal in preventing conception.

- a) What is the name given to such procedures in males and females?
- b) How does it prevent conception?
- c) Name the things used with barrier contraceptives to increase their contraceptive efficiency.
- d) Give the symptoms of Sexually transmitted diseases.

4. (a) Expand the term IMR. Write the recent trend in it. Mention any two reasons for this type of trend.
 (b) Emergency Pills are used to avoid possible pregnancy. How do these pills work?
 (c) What are the features of ideal contraceptive?
 (d) Mention three initiatives taken by the government to overcome the population growth

5. In the blanks given below select and enter one correct device out of the following:

[Oral pill, condom, copperT, saheli, vasectomy, diaphragm, tubectomy, cervical caps]

S.No	Methods of control	device
1.	barrier	
2.	IUD	
3.	surgical	
4.	Administering hormone	

6. What do you mean by reproductive health? Mention the different ways in which people are made aware of reproductively healthy society.
7. Ratan lives in a remote village. Suddenly he comes to know that his father has arranged the marriage of his younger sister, who is only 14 years old, to a well-to-do middle aged man living in a nearby village. Ratan objected to his father's act. Ratan was not convinced by his father's idea that a better groom might not be available later. Ratan complained to the village head and got the problem solved.
- a) Did Ratan act properly by approaching the village head? Why/ Why not?
 - b) What biological considerations made Ratan object to his father's decision?
 - c) What values and responsibilities did Ratan show?
8. Anita was happy when she gave birth to her first child. Her in-laws were dissatisfied at her not giving birth to a male child and blamed Anita. Anita tried to convince her in-laws that she had no role in the child's gender. They understood the biological reason but were yet to be satisfied. Anita's husband took up the matter and convinced the parents.
- a) What values did Anita's husband show in the above situation?
 - b) What governs sex determination in humans? How is it different from birds?
 - c) Why can't Anita be blamed for not giving birth to a male child?
9. A barrier method prevents conception is said to be user friendly, easily available and prevent STD's. Identify the given diagram. What it is used for?
-

SYNOPSIS **CHAPTER -5**

PRINCIPLES OF INHERITANCE AND VARIATION

Some important points and definitions

- Heredity: It is the transmission of characters from one generation to successive generations of living things.
- Genetics: Branch of biology which deals with principles of inheritance and variations of characters from parents to offspring.
- Variation : It is the degree by which progeny differ from their parents.
- Alleles: The various forms of genes.
- Codominant gene: The alleles, each of which produces the independent effect when homozygous and express equally when in combination.
- Pedigree: A table chart or diagram representing the ancestral history of an individual.
- Pedigree Analysis: Analysis of traits in a several generations of a family.
- Multiple allelism: More than two allelic forms exist for certain genes and they controls same characters.
- Co-dominance: In this F1 generation resembles both the parents . Co-dominance means both the alleles are equally dominant and hence both express themselves equally in their phenotype .
- Multiple Alleles: One character represented by more than two alleles.
- Dihybrid Cross: Cross between plants differing in two traits(characters).
- Pure breeding varieties : The varieties that have under gone continuous self pollination ,shows stable trait inheritance and expression for several generations.
- Genes: Stable and discrete units that controlled the expression of traits.

- Incomplete Dominance: In this F1 offspring has a phenotype which is intermediate between two parental traits. In these plants, when two dissimilar factors are present, it shows the phenotype that did not resemble either of two parents and their phenotype will be in between the two traits.
- Function of a gene- contain information to express a particular trait.

Phenotypic and genotypic ratios

- Phenotypic ratio of monohybrid crosses: 3:1
- Genotypic ratio of monohybrid cross: 1:2:1
- Phenotypic ratio of dihybrid crosses 9:3:3:1
- Genotypic ratio of dihybrid cross 1:2:2:1:4:2:1:2:1
- Phenotypic and genotypic ratio of incomplete dominance -1:2:1

The reasons for selecting pea plant for Mendel' experiments

- It is small, easy to grow and cross breed artificially.
- They are normally self pollinated but they can be readily cross pollinated if self pollination is prevented.
- It completes its life cycle in one season and produce large number of offspring. 4. A large number of true breeding varieties were available.

How does Incopmplete dominance differ from dominance

- Dominance is the interaction between the allelic pairs of the same gene. In this dominant allele masks the expression of the other allele.
- In incomplete dominance neither dominant allele nor recessive allele has any expression. It has a intermediate character.

Principles or Laws of inheritance

First Law (Law of Dominance)

- Mendel proposed that each genetic Character is controlled by a pair of unit factors called alleles. When two dissimilar unit factors are present in a single individual, only one is able to express and the other is not able to express. The one that expresses is called dominant unit factor and the other which fail to express is called recessive unit factor . Dominant characters are expressed when factors are heterozygous. Recessive character is expressed when it becomes homozygous.

Postulate2 (Law of segregation)/ Purity of gametes

- When an individual produces the gametes, the alleles segregate or separate. So each gamete receives only one member of the pair of alleles and the pair condition is restored by random fusion of gametes during fertilization. Allels do not show any blending.

Postulate 3(Law of independent assortment of factors)

- This law states that when two pairs of traits are combined in a hybrid, Segregation of 1 pair of character is independent of the other pairs of characters.

Chromosome theory: Proposed by Walter Sutton and Theodora Boveri.

- This theory states that the Mendelian factors or genes are located on chromosome and it is the chromosome that segregates and assort independently during meiosis. Pairing and separation of a pair of chromosomes would lead to the segregation of a pair of factors they carried.

Locus: The position of gene on the chromosome

Recombination: Generation of non-parental gene combination. frequency of recombination between gene pairs is a measure of the distance between genes .Genetic map is used to locate the position of genes on the chromosomes

Linked genes: Physical association of genes on chromosome

Linkage: The tendency of genes to inherit together in gametes.

Linkage group: The group of linked genes located on the same chromosome inherited in the gametes or progeny as a single group is called linkage.

The reasons for selecting drosophila for Morgan's experiments

- They can be grown on simple synthetic medium.
- They complete their life cycle in about two weeks.
- Single mating can produce a large number of progenies.
- There is clear distinction of the male and female flies.
- It also has many types of hereditary variations.

Wild type fly : Red eyed ,brown body and normal wing.

Mutant : white eyed , yellow body and miniature wing.

Result of the cross between mutant female and wild male

- Yellow bodied and white eyed female X Brown bodied and red eyed male
- Brown bodied and red eyed male and yellow bodied and white eyed male
- Intercrossed the progeny . genes did not segregates independently of each other. F2 ratio deviated from the ratio of dihybrid cross.
- These genes were located on X chromosome.
- Proportion of parental gene combination were much higher than non-parental type.
- Genes for white eye and yellow body were tightly linked and showed only 1.3 percent recombination.
- But some genes were loosely linked and showed higher recombination. Example gene for white and miniature wing .

MECHANISM OF SEX DETERMINATION

X0 mechanism-Grass hopper / insects(XX-X0)

- Female insect -autosomes + XX
Eggs have autosome and one X chromosome. So female has pair of XX chromosomes.(2A+XX)
- Male insect -autosomes + X0

Sperms are two types .

So they express male heterogamety i) One with autosome and X chromosomes(A+X) ii) One with autosome only(A+0)

- So male has only one X chromosome. (2A+X0)
- Female-Produced by the fertilization between the egg and sperm with X chromosome.
- Male-Produced when egg fertilizes the sperms without X chromosome.

XY type of sex determination(XX-XY)

- Males have autosome + XY Female have autosome + XX
- Male produce two types of gametes one with X chromosome and some with Y chromosomes. So they express male heterogamety.

ZW type of sex determination (ZZ-ZW)

- ZZ-ZW mechanism is seen in many birds. Two different ovum produced by female. Total number of chromosome is same in male and female.
- Female bird : Autosomes +ZW .this produce two types of gametes . So they express female heterogamety.
- Male bird :Auto somes +ZZ.this produce only one type of gamete.

Factors leading to genetic variation

- i) recombination
 - ii) gene mutation
 - iii) chromosomal aberrations
-
- **Mutation:** This is a phenomenon which results in alteration of DNA sequences and cause changes in genotype and phenotype of an organism.
Types of mutations
 - point mutation: This arise due to change in single base pair of DNA. Example sickle cell anemia is caused due to the change of one base in the gene coding for beta chain of hemoglobin.
 - frameshift mutations: Caused by the deletion and insertion of base pairs of DNA
 - Chromosomal aberrations: changes in the chromosomes which bring visible changes in the phenotype.
 - Chromosomal aberrations are of two types
 - i) changes in chromosome structure ii) change in chromosome number

Mutation due to alteration in chromosome.

DELETION

1. part of chromosome is lost

DUPLICATION

1. a portion of chromosome is repeated

Mutation due to Changes in chromosome number

EUPLOIDY

1. Monoploid -.Basic set of chromosome number (x)
2. Euploids –these are having multiple of monoploid number (2x)
3. Polyploids -.Caused due to the change in the whole set of chromosomes

ANEUPLOIDY

1. This is due to the change in a subset of chromosome number. This leads to the loss or gain of one or two homologous chromosome. This happens due to the failure of segregation of chromatids during cell division cycle.
2. monosomy –loss of one chromosome (2n-1)
3. Trisomy –gain of one chromosome there is an extra copy of 21st chromosome.(2n+1).Example – Down's syndrome.

Chromosome composition	Chromosome number	Type of effect	Sexual differentiation and symptoms.
2A+XXY	47	Klinefelter's syndrome	Male : Has overall masculine. development. but feminine. development is also expressed. They are sterile.
2A+XO	45	Turner's syndrome	Female :sterile has Rudimentary ovaries and lack secondary sexual characters.
TRISOMY OF 21st chromosomes	47	Down's syndrome	Male or Female short stature with small round head, furrowed tongue, partially opened mouth, broad palm with characteristic palm crease. Physical, psychomotor and mental development is retarded.

Polygenic trait –Quantitative Inheritance

Polygenic traits are controlled by two or more than two genes (usually by many different genes) at different loci on different chromosomes. These genes are described as polygenes. Examples of human polygenic inheritance are height, skin colour and weight. Polygenes allow a wide range of physical traits. For instance, height is regulated by several genes so that there will be a wide range of heights in a population

The polygenic inheritance is also known as quantitative Inheritance as the trait is affected by the quantity of recessive or dominant genes.

- The polygenic traits exhibit gradation as seen in human skin.
- Human skin colour can grade from black to white.

- Human height also a gradation from short to tall forms .
- Gradations may be seen in many less familiar traits like seed size of beans, grain colour in wheat or con length in corn. Though both heredity and environment contribute to the production of graded phenotypes, continuous variation is often due to the additive effects of two or more genes for the trait. They are POLYGENIC TRAITS.
- Human skin colour is believed to be controlled by atleast three separate genes. Each contributes to a unit of darkness due to INCOMPLETE DOMINANCE.
- Designating the genes A,B and C , the skin shape will vary from very dark in a AABBCC individual to very light in a aabbcc individual. A person with AaBbCc (i.e heterozygous for all the three genes) will have a intermediate colour.
- The number of possible allele combination in the eight for such a persons .So a total of 64 phenotypic combinations are possible when two persons of similar genetic constitutions marry.

PLEIOTROPY

- Pleiotropy describes the genetic effect of a single gene on multiple henotypic traits. Thus a polygenic gene has an ability of many effects. The term "pleiotropie" was coined in a 1910 Festschrift
- A classic example of pleiotropy is the human disease PKU (phenylketonuria). This disease can cause mental retardation and reduced hair and skin pigmentation, and can be caused by any of a large number of mutations in a single gene that codes for the enzyme (phenylalanine hydroxylase), which converts the amino acid phenylalanine to tyrosine, another amino acid. Depending on the mutation involved, this results in reduced or zero conversion of phenylalanine to tyrosine, and phenylalanine concentrations increase to toxic levels, causing damage at several locations in the body. PKU is totally benign if a diet free from phenylalanine is maintained.
- A famous example of pleiotropy is sickle cell anaemia. A recessive gene causes this disease.The gene causes the production of abnormal haemoglobin. As a consequence the shape of red blood cell containing it , becomes distorted and become sickle shape
- Homozygous individual normally die early in life due to severe anaemia in the distorted cells. anaemia cause by premature destruction of the sickled red cells. But heterozygous individuals who have both normal and abnormal haemoglobin and who also have mild anemia are naturally protected against contracting malaria as a parasite cannot live in the distorted cells.
- Hetrozygotes may survive better in regions where malaria is endemic. Such populations have both normal individuals and individuals hetrozygous to the genes.
- The Hetrozygous individuals are the carriers of the genes from generations to generations.

The Antagonistic pleiotropy

- Antagonistic pleiotropy refers to the expression of a gene resulting in multiple competing effects, some beneficial but others detrimental to the organism.

THALASSEMIA

- Thalassemia is a blood disorder passed down through families (inherited) in which the body makes an abnormal form of hemoglobin, the protein in red blood cells that carries oxygen. The disorder results in excessive destruction of red blood cells, which leads to anemia

Causes, incidence, and risk factors

- Hemoglobin is made of two proteins: Alpha globin and beta globin. Thalassemia occurs when there is a defect in a gene that helps control production of one of these proteins.
- There are two main types of thalassemia:
 - Alpha thalassemia occurs when a gene or genes related to the alpha globin protein are missing or changed (mutated).
 - Beta thalassemia occurs when similar gene defects affect production of the beta globin protein. Alpha thalassemia's occur most commonly in persons from southeast Asia, the Middle East, China, and in those of African descent.

Beta thalassemias occur in persons of Mediterranean origin, and to a lesser extent, Chinese, other Asians, and African Americans.

There are many forms of thalassemia. Each type has many different subtypes. Both alpha and beta thalassemia includes the following two forms:

- Thalassemia major
- Thalassemia minor

You must inherit the defective gene from both parents to develop thalassemia major.

Thalassemia minor occurs if you receive the defective gene from only one parent. Persons with this form of the disorder are carriers of the disease and usually do not have symptoms.

Beta thalassemia major is also called Cooley's anemia.

Symptoms

The most severe form of alpha thalassemia major causes stillbirth (death of the unborn baby during birth or the late stages of pregnancy).

Children born with thalassemia major (Cooley's anemia) are normal at birth but develop severe anemia during the first year of life.

Other symptoms can include:

- Bone deformities in the face
- Fatigue

- Growth failure
- Shortness of breath
- Yellow skin (jaundice)

Persons with the minor form of alpha and beta thalassemia have small red blood cells (which are identified by looking at their red blood cells under a microscope), but no symptoms.

CHAPTER 5

PRINCIPLES OF INHERITANCE AND VARIATION

1-MARK QUESTIONS-MCQ's

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

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

ASSERTION REASON

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

Assertion.

- (c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

1. **Assertion :** Mendel was successful in his hybridization.

Reason : Garden pea proved ideal experimental material.

2. **Assertion:** Mendel used true-breeding pea lines for artificial pollination experiments for his genetic studies.

Reason: For several generations, a true-breeding line shows the stable trait inheritance and expression.

3. **Assertion:** On true breeding lines, Mendel conducted cross pollination experiments.

Reason: For several generations, true breed line have stable trait inheritance.

4. **Assertion :** Cross of F1 individual with recessive homozygous parent is test cross.

Reason : No recessive individual are obtained in the monohybrid test cross progeny.

5. **Assertion:** The progeny produced have both the characters of parents.

Reason: The process by which characters pass from parent to progeny is known as inheritance.

2-MARK QUESTIONS

1. Give the symbols used in human pedigree analysis of a) Mating b) Consanguineous mating c) Sex unspecified d) Affected individuals
2. Explain why the term homozygous and heterozygous with respect to a X-linked trait are applicable to human females but not human males.
3. In rabbits' black skin color (B) is dominant over brown (b) and short hair (S) is dominant over long hair (s). If homozygous black long haired is crossed with homozygous brown short haired female, what will be the genotype of F₂ generation. Explain using a Punnet Square.
4. Write the dominant forms of the following traits in garden pea-i) Flower position ii) pod shape a. iii) Seed shape iv) pod color
5. Give two main reasons why it is not possible to study inheritance in humans the same ways as peas?
6. Define codominance. Give example how a single gene can produce more than one effect.
7. Name the breed of cow which has been developed through artificial selection and domestication of wild cows.
8. Which Mendel's law of Inheritance is universally acceptable without any exception? State the law.
9. Given below are the results of two dihybrid crosses conducted by Mendel for Drosophila.

Cross	Result
CROSS A	Parental types 98.7% Recombinant types 1.3%

CROSS B	Parental types 92.8 % Recombinant types 37.2%
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- a. Interpret the results of cross A and Cross B.
- b. Explain the reason for obtaining such result.
- c. How does it differ from true Mendel dihybrid ratio ?

10. 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.

11. Name the enzyme impaired in Phenyl ketonuria. How does this impairment affect the person afflicted with this disease?

12. Tall (TT) is dominant over dwarf (tt), red (RR) is incomplete dominant over white (rr) producing pink (Rr). The tall white flowered plants are crossed with dwarf red flowered plants. Give the progeny in F₁ and F₂ generations with phenotypic and genotypic ratio.

13. What is meant by polygenic trait? Site an example?

14. Why skin color in man is known as quantitative inheritance?

15. Why the people with heterozygous sickle cell anemia survive better in malaria prone areas?

16. Explain how an XXY individual can arise in human?

17. Recently a baby girl has been reported to suffer from hemophilia. How is it possible? Explain with the help of a cross

18. In one family each of the four children has a different blood group. Their mother is group A and the father is group B. Explain this pattern of inheritance, with the help of a cross along with the genotypes.

3 MARK QUESTIONS

1. Name the three laws of inheritance. Define the law which cannot be explained by the following cross in which the height character of the plant is studied.

TT x Tt

2. Show a cross with proper example where law of dominance is (a) Followed (b) not followed.

i) Determine the sex of –

a grasshopper with autosomes and XO chromosomes.

a bird with autosomes and XX chromosomes.

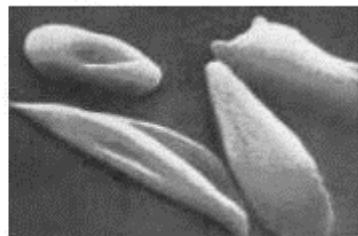
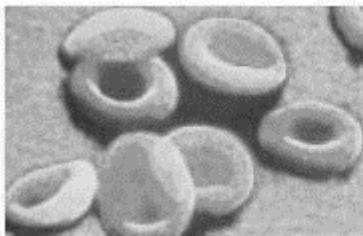
(ii) Linkage and recombination of genes is seen during inheritance of the characters. Which of these two will result into variation in a species? Why?

3. Explain the phenomenon of multiple allelism and co dominance by taking the example of ABO blood group in human beings.

4. 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.
5. 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.
6. Mention three differences between Turner 's syndrome and Klinefelter's syndrome.
7. 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.
8. A hemophilic man marries a normal homozygous woman. What is the probability that their daughter will be hemophilic?
9. 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.
10. (a) Expand UTR. Write its function
(b) What is frame shift mutation along with example? (c) How tailing and capping is done?
11. If a cross is made between a hybrid tall and red flowering plant with a dwarf and white flowering plant. What will be the phenotypic and genotypic ratio? What are such crosses called? Mention the importance of such crosses.
12. With a suitable example, explain pleiotropy. Which of the genes studied by Mandel in pea is now considered to be pleiotropic?
13. State the causes and symptoms of thalassemia.
14. A cross is made between different homozygous pea plants for contrasting flower positions. Find out the position of flowers in F₁ generation on the basis of genotypes.
 - i) Work out the cross up to F₂ generation.
 - ii) Compute the relative fraction of various genotypes in the F₂ generation?
15. Some human disorders are inherited and have been prevailing in human society since long. Since the controlled crosses are not possible in case of human beings ,the study of the family history provides an alternative about the inheritance of such disorders
 - i) Name the analysis used to study the inheritance f such a disorder. ii) Name two human disorders which could be traced by this analysis iii) Explain the effect of any such disorder in humans?

CASE STUDY

1. Observe the following diagram-



- a) What does it show?
- b) Which genetical defect causes it?
- c) What is the consequence of this genetic defect on the person involved? d) What are the symptoms of this disease?

5 Marks Question

1. Mendel's Monohybrid cross is mathematically condensable to the form of a binomial expression.
 - a) Which expression is this? b) Prove it.
2. Explain the concept of dominance using capacity of a gene to produce an enzyme as the basis.
3. Give the contribution of the following scientists to the field of Genetics a) Reginald Punnet
b) Alfred Sturtevant c) Henking d) Langdon Down e) Sutton
4. Give the cause and symptoms of i) Down's syndrome
ii) Klinefelter's syndrome iii) Turner's syndrome
5. Ravi was rushed to a nearby hospital after an accident which caused a lot of blood loss. The hospital failed to supply O negative blood for transfusion. Rahman who was attending a patient learned about the situation and agreed to donate blood being of the same blood group. Ravi's mother initially refused but was later convinced by her daughter.
 - a) What values do you find in Ravi's sister and Rahman?
 - b) Why can't O positive blood be transfused into Ravi's body?
 - c) What is the genetic basis of blood group inheritance?
6. Brijmohan angrily says to his daughter not to marry Rajiv since their family is known to inherit Haemophilia. The daughter objected to her father's order. Brijmohan was adamant and threatened Rajiv also. Brijmohan's daughter explained the biological interpretation of his fear and convinced her father.
 - a) Rajiv was not haemophilic. Why was Brijmohan so worried?
 - b) What values do you identify from the role played by Brijmohan's daughter?
 - d) Is there any fear of haemophilia if Brijmohan's daughter marries Rajiv?
7. Ratan was a known sportsman in his school. While returning home he found some unknown miscreants beating a young fellow. He tried to drive them off but by that time the fellow died of injury. The police arrested Ratan and he was put on trial. The judge being convinced by Ratan's plea, ordered for DNA finger printing reports.

- a) Ratan's fingerprints on the dead body were sufficient to convict him but the judge asked for authentic proof? What values can be observed?
- b) What is the basis of DNA finger printing?
- c) Explain the steps in DNA finger printing.
8. Mallika was working with a multinational company and doing very well. But her mother was very much worried about her marriage as she was already 32 years old. She made her understood the consequences of late marriage and motherhood and convinced her to get married. Though her boss was reluctant to give leave,
- a) Did Mallika take the correct decision of getting married? What values did she show?
- b) What are the consequences of late motherhood?
- c) Name some disorders which may result due to late motherhood?
9. Sonam is a bright, fair girl. Her parents are dark complexioned. Her friends in college regularly passed remarks asking her how she was so fair or what treatment she had undergone to become fair. Sonam got irritated at their repeated embarrassing questions.
Her friend Srijita came to her support and invited the friends to the Biology lab where she explained the inheritance of body colour. The friends realised their mistake and stopped teasing Sonam.
- a) What good values did Srijita reflect from her deeds?
- b) What is the name of the inheritance pattern discussed?
- c) Which other characters in humans follow the same pattern?
- d) Explain how Sonam could be fairer than her parents

SYNOPSIS **CHAPTER 6**

MOLECULAR BASIS OF INHERITANCE

Meselson and Stahl's experiment to prove the semi conservative replication of DNA

- Semi conservative replication is the type of replication where in each daughter molecule of DNA has one old strand and one newly synthesized. Meselson and Stahl in late 1950s experimented on bacterium Escherichia coli and showed that DNA replication is indeed semi conservative.
- They grew E. coli in a medium containing $^{15}\text{NH}_4\text{Cl}$. The DNA of bacteria got labelled with ^{15}N .
- Then they transferred the bacterial cells into the medium that contain $^{14}\text{NH}_4\text{Cl}$.
- The analysis was done after different number of generations.
- After transferring the cells from ^{15}N to ^{14}N medium, DNA is extracted from the culture after 20 minutes.
- First generation it showed that density of DNA was intermediate between the heavier ^{15}N DNA and the lighter ^{14}N DNA.
- After second generation it showed that one half of DNA was between ^{14}N and ^{15}N whereas other half was in ^{14}N density region.
- Thus, these experiments prove that DNA shows semi conservative replication.
- Two organisms used for confirming the semiconservative nature of DNA: -E. coli and Vicia faba

DIFFERENT TYPES OF RNA

mRNA: It is synthesized by DNA to carry the information from the DNA to the site of protein synthesis in the form of nucleotide triplets(codons).

rRNA: They are assembled into ribosomes. It helps in the synthesis of proteins.

tRNA: It carries amino acids from the cytoplasm to the ribosomes for protein synthesis.

STRUCTURE OF tRNA

- Transfer RNA molecules occur in the cytoplasm of a cell.
- The two-dimensional structure of tRNA is in the form of clover-leaf.
- In three-dimension tRNA is a compact molecule look like inverted L-.
- The tRNA is a folded molecule consists of 4 double stranded regions formed by hydrogen bonding between bases forming three loops. It has 3' and 5' ends.
- The amino acids attaches to the 3'end of tRNA.
- The tRNA has a region that contains the complementary bases, known as Anticodon.

Griffith's experiment in streptococcus pneumoniae bacteria to demonstrate transformation

Griffith conducted experiments on *Diplococcus pneumoniae* which causes pneumonia in mice. This bacterium has two types:

i) Smooth walled: S-Strain- They are virulent and has mucous polysaccharide coat and cause pneumonia **ii) Rough walled: R-strain-** does not have a mucous coat and non-virulent: they do not cause pneumonia.

He performed his experiment in the following four steps:

- He injected 'S' strain bacteria into mice.
- The mice suffered from the disease and then died.
- 'R' strain bacteria were injected into mice. The mice did not suffer from pneumonia.
- He injected heat killed 's' cells into mice, the mice did not suffer from disease.
- He injected a mixture of heat killed 'S' cells and live 'R' cells into mice.
- The mice suffered from the disease and then died
- The bacteria isolated from dead bodies of these mice were found to be 'S' type.
- By these results he concluded that some transforming principle is transferred from heat killed S strain to R strain and enabled R strain to synthesize smooth polysaccharide coat and became virulent.
- It is the 'R' type of bacteria which got transformed into 'S' type and this process is called as transformation.

WHO has determined the biochemical nature of transforming principle in Griffith's experiment.

- Later **Oswald Avery, Colin Macleod and Maclyn McCarty proved that the transformation material is DNA.**
- They purified the biochemicals like protein, DNA, RNA from the heat killed S cells and injected into R cells to see whether they transform into S cells.
- They found that only DNA from S bacteria transformed R bacteria into S bacteria.

Hershey and chase experiment to demonstrate that DNA is genetic material

- They worked with viruses that attack bacteria called bacteriophages
- These viruses attach to bacterial cells and its genetic material enters to bacterial cell.
- They grew some viruses on a medium with radioactive phosphorous and thus its DNA was made radioactive (with p35).
- They grew some viruses on a medium with radioactive sulphur and the protein part was made radioactive (with s35).
- E. coli cells were infected with radioactive phages separately until the lysis of bacteria. Immediately after the infection.
- The bacterial cells were agitated in a blender to remove viral coats from bacterial and viral particles were separated from bacteria by spinning them in a centrifuge.
- It was found that bacterial cells were heavier and settled at the bottom whereas the supernatant contained the light viruses and their other components.
- It was found by Hershey and chase that when bacteriophage containing radioactive protein was used in the infecting agent, all radioactive material was limited to phage particles in supernatant.
- When bacteriophage containing radioactive, DNA was used to infect E. coli, bacterial cells shown radioactivity and also appeared in the progeny phage.
- Thus this blender experiment indicated that during infection with virus it is the DNA that actually enters into bacteria.
- It also indicates that during infection bacterial cells treat the viral DNA as its own genetic material and carries the message for synthesis of more viral particles.

- This experiment shows that it is the viral DNA that contains information for the production of more viral particles. Thus DNA should be the genetic material

The process of replication

- The intertwined DNA starts operating from a particular point called Origin of replication.
- Double helix unwinds to separate the two strands and each strand act as templates.
- The double stranded DNA is unwound upto a point and it will give rise to Y Shaped structure called *replication fork*.
- *Initiation of DNA synthesis* is done by RNA primer which is synthesized by enzyme primase.
- RNA primer is a short segment of RNA nucleotides.
- Many enzymes are required to complete the process of replication.
- After the formation of RNA primer, new nucleotides are added with the help of enzyme DNA dependant DNA polymerase.
- The replication proceeds only in 5' → 3' direction.
- The building blocks of DNA are present only in the form of dATP, dTTP, dGTP, dCTP in the nucleus.
- Two strands of DNA run anti parallel to each other and DNA polymerase catalyze the polymerization only in 5'-3' direction only. Because of this DNA synthesis takes place in two ways, one in continuous synthesis and the other in discontinuous DNA synthesis.
- The strand which is produced in continuous stretch is called *leading strand*.
- In the other strand, DNA polymerase produces short fragments of DNA called *okazaki fragments* and the strand is called *lagging strand*. These strands eventually joined together by another enzyme called *DNA ligase*.
- Replication of DNA takes place at the S phase of the cell cycle.
- There should be coordination between cell division cycle and replication DNA

Names of enzymes that take part in DNA synthesis and their functions -

- a) RNA polymerase -----synthesize RNA primer.
- b) DNA polymerase I, II, III----DNA synthesizing enzymes.
- c) Ligase -----seal okazaki fragments

The differences between the transcription in prokaryotes and eukaryotes

DNA

1. Mainly present in the chromosomes in nucleus.
2. Formed of double helix coiled spirally
3. The sugar molecule is deoxyribose
4. The nitrogen bases are Adenine and Guanine, Cytosine and Thymine.
5. They are the hereditary material in all cells.
6. They carry genetic information that is passed from one generation to next generation and also controls various cellular activities.

RNA

1. Mainly found in the cytoplasm. But also seen in nucleolus.
2. Formed of a single strand only
3. The sugar molecule is ribose

4. The nitrogen bases are Adenine, Guanine, Cytosine and Uracil.
5. It is hereditary material only in retroviruses
6. Participates in protein synthesis.

LAC OPERON

- It constitutes the catabolic pathway . i.e. Break down of lactose sugar.
- Polycistronic structural gene is regulated by common promoter and regulatory genes. This together is known as operon.
- Lac operon has operator ,promoter, regulatory gene i gene and three structural genes z,y and a . z which code beta-galactosidase for the hydrolysis of lactose ,y gene codes for permease that increase the permeability of the cell to B galactosidase and a gene codes for transacetylase.
- Repressor protein produced by regulatory gene i. gene can bind with the operator and can block RNA polymerase movement.
- In this operon the metabolite is required to induce the transcription of structural genes for its own breakdown.
- Lactose is the substrate for the enzyme B-galactosidase and it regulates the switching on and off the operon .this is termed as inducer.
- The lactose molecule binds to repressor and modifies its structure in such way that repressor cannot bind to operator.

The differences between the transcription process in prokaryotes and eukaryotes -

EUKARYOTE

1. They have three types of RNA polymerase called RNA polymerase I, II and III .
2. Promoter region is recognized by transcription factors.
3. They produce mono cistronic mRNA
4. Transcription takes place in nucleus and moves to the cytoplasm for translation .
5. mRNA is processed from RNA transcript by maturation process.
6. Transcription and translation takes place separately.

PROKARYOTE

1. They have only one type of RNA polymerase.
2. RNA polymerase binds to promoter region which is recognized by sigma subunit of RNA polymerase.
3. They produce polycistronic mRNA.
4. Transcription takes place in cytoplasm.
5. There is no maturation process.
6. Transcription and translation can be coupled in bacteria.

Various major steps involved in synthesis of polypeptide (Translation)

1. Activation of amino acids
2. Initiation
3. Elongation
4. Termination

Activation of amino acids during polypeptide synthesis

- The specific amino acid can be attached to the 3'-end of a specific tRNA molecules in the cytoplasm of a cell. Amino acids are activated in the presence of ATP. This whole process is known as charging of amino acid or aminoacylation of tRNA.
- Thus each tRNA is charged with the appropriate amino acid. The charged tRNA carry the amino acid to the ribosome site for protein synthesis.

Initiation

- The small ribosomal subunit binds to the mRNA in presence of initiation factors.
- A transitional unit in mRNA is the sequence RNA that is flanked by the start codon and the stop codon.
- The ribosome binds to the mRNA at the start codon and it is recognized only by the initiator tRNA
- The aminoacid tRNA complex attaches to the codon AUG on mRNA through its anticodon UAC to form the small ribosomal initiation complex.
- The larger subunit joins to initiation complex to form the complete initiation complex.

Elongation of chain

- The second complex composed of an amino acid linked to tRNA sequentially bind to the appropriate codon in mRNA by forming complementary base pairs with tRNA anticodon .
- A peptide bond forms between these two closely situating charged tRNA.. ribosome act as a catalyst for the formation of peptide bond .
- The ribosome moves from one codon to codon along the mRNA.
- Amino acids are added one by one and translate into polypeptide sequences and this is dictated by DNA and represented by RNA .

Termination of polypeptide chain

- tRNA cannot interact with codons UAA, UAG and UGA .
- They are present at the end of 3' end of mRNA .
- When the sequence of elongation reaches stop codons , a release factor binds to the stop codon and terminate translation and release the complete polypeptide from the ribosome.

Watson and crick model of DNA

- DNA consists of two polynucleotide strands.
- These chains form a double helix like a spiral staircase.
- The sugar phosphate units form the backbone and nitrogen bases forms the centre.
- Both the strands are joined together by weak hydrogen bonds.
- The two strands are antiparallel to each other. One strand runs in 3'-5' direction and the other is in 5'-3' direction.
- The width of a DNA molecule is 2nm

- The helix takes a complete turn after 3.4 nm.
- There are ten base pairs in a complete turn of DNA molecule.
- The distance between two adjacent pair is 0.34nm.
- One chain has any sequence of bases, but the other chain has to be complementary.
- If there is purine base on one helix it has to be pyrimidine on the other.
- This is called base-pairing. It is very specific, and the only pattern followed is
 A=T (two hydrogen bonds) C=G(three hydrogen bonds)
 Adenine and Guanine are purine Thymine and Cytosine are pyrimidine.
- The nucleotides are joined together by phosphodiester bonds
- The sugar present is deoxyribose.
- According to Chargaff's rule ratio between the adenine and thymine and ratio between the Guanine and Cytosine are constant and equals to one $[A] = [T]$; $[G] \equiv [C]$

Central dogma

- Francis Crick proposed the Central dogma in molecular biology, which states that the genetic information flows from DNA to RNA to Protein.
- In some viruses the flow of information is in reverse direction, from RNA to DNA. It is called reverse transcription.
- Length of DNA double helix in a mammalian cell is total number of bp x distance between two consecutive bp. $(6.6 \times 10^9 \text{ bp}) \times (0.34 \times 10^{-9} \text{ m/bp}) = 2.2 \text{ metres.}$

DNA HELIX

- Prokaryotes do not have a defined nucleus.
- Negatively charged DNA is held with some positively charged proteins in a region termed as 'nucleoid'.
- The DNA in nucleoid is organized in large loops held by proteins.

In eukaryotes -

- Organization is much more complex.
- There is a set of positively charged, basic proteins called histones.
- Histones are rich in lysine , arginine and the amino acid residues carry positive charges in their side chains.
- Histones are organized to form a unit of eight molecules called as histone octamer.
- The negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.
- A typical nucleosome contains 200 bp of DNA helix.
- Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin.
- The nucleosomes in chromatin are 'beads-on-string' structure when viewed under electron microscope.
- The beads-on-string structure in chromatin is packaged to form chromatin fibers.
- They are further coiled and condensed at metaphase stage of cell division to form chromosomes.
- The packaging of chromatin at higher level requires additional set of proteins that collectively are referred to as histones.

Euchromatin

- In a typical nucleus, some region of chromatin is loosely packed. It stains light and are referred to as euchromatin.
- Euchromatin is said to be transcriptionally active chromatin.

Heterochromatin: The chromatin that is more densely packed and stains dark are called as Heterochromatin., whereas heterochromatin is inactive. discovery of nuclein by Miescher.

A molecule that can act as a genetic material must fulfill the following criteria:

- (i) It should be able to generate its replica (Replication).
- (ii) It should chemically and structurally be stable.
- (iii) It should provide the scope for slow changes (mutation) that are required for evolution.
- (iv) It should be able to express itself in the form of 'Mendelian Characters'.

Why is DNA better genetic material than RNA ?

- 2'-OH group present at every nucleotide in RNA is a reactive group and makes RNA labile and easily degradable.
- RNA is catalytic, hence reactive, so it is less stable
- DNA chemically is less reactive and structurally more stable when compared to RNA. The presence of thymine at the place of uracil also confers additional stability to DNA. Therefore, among the two nucleic acids, the DNA is a better genetic material.

Why do the viruses mutate faster than other organisms?

- Both DNA and RNA are able to mutate.
- RNA being unstable, mutate at a faster rate.
Consequently, viruses having RNA genome and having shorter life span mutate and evolve faster.

How is DNA related to RNA?

- RNA can directly code for the synthesis of proteins, hence can easily express the characters.
- DNA, however, is dependent on RNA for synthesis of proteins. The protein synthesizing machinery has evolved around RNA.

Which is the first genetic material?

- RNA was the first genetic material.
- There is now enough evidence to suggest that essential life processes (such as metabolism, translation, splicing, etc.), evolved around RNA.

RNA act as a genetic material as well as a catalyst:

- There are some important biochemical reactions in living systems that are catalyzed by RNA catalysts and not by protein enzymes.
- RNA being a catalyst was reactive and hence unstable. Therefore, DNA has evolved from RNA with chemical modifications that make it more stable.
- DNA being double stranded and having complementary strand further resists changes by evolving a process of repair.

The salient features of genetic code are as follows:

- The codon is triplet.
- 61 codons code for amino acids and 3 codons do not code for any amino acids, they function as stop codons.
- One codon codes for only one amino acid, hence, it is unambiguous and specific
- Some amino acids are coded by more than one codon; hence the code is degenerate.
- The codon is read in mRNA in a contiguous fashion. There are no punctuations.
- The code is nearly universal.
- AUG has dual functions. It codes for Methionine (met) , and it also act as initiator codon

DNA FINGER PRINTING

- The technique of DNA Fingerprinting was initially developed by Alec Jeffreys.
- He used a satellite DNA as probe that shows very high degree of polymorphism.
- It was called as Variable Number of Tandem Repeats (VNTR).
- The technique involves Southern blot hybridization using radio labelled VNTR as a probe.
- The VNTR belongs to a class of satellite DNA referred to as mini satellite.
- It is a small DNA sequence is arranged tandemly in many copy numbers.
- The copy number varies from chromosome to chromosome in an individual.
- The numbers of repeat show very high degree of polymorphism.
- As a result, the size of VNTR varies in size from 0.1 to 20 kb.
- Consequently, after hybridization with VNTR probe, the autoradiogram gives many bands of differing sizes.
- These bands give a characteristic pattern for an individual DNA. It differs from individual to individual in a population except in the case of monozygotic (identical) twins.
- The sensitivity of the technique has been increased by use of polymerase chain reaction (PCR– you will study about it in.DNA fingerprinting has application in forensic science, in determining population and genetic diversities. Currently, many different probes are used to generate DNA fingerprints.

STEPS IN DNA FINGER PRINTING

- (i) Isolation of DNA.
- (ii) Digestion of DNA by restriction endonucleases.
- (iii) Separation of DNA fragments by electrophoresis.
- (iv) Transferring (blotting) of separated DNA fragments
- (v) Hybridization using labeled VNTR probe.
- (vi) Detection of hybridized DNA fragments by autoradiography.

CHAPTER 6: MOLECULAR BASIS OF INHERITANCE

1-MARK QUESTIONS-MCQ's

1. The nucleic acid synthesis takes place in

- a. 3'-5' direction
- b. 5'-3' direction
- c. Both ways
- d. Any direction

2. What is the nature of the strands of the DNA duplex?

- a. Anti-parallel and complementary
- b. Identical and complementary
- c. Anti=parallel and non-complementary
- d. Dissimilar and non-complementary

3. Hershey and Chase's experiment was based on the principle

- a. Transformation
- b. Translation
- c. Transduction
- d. Transcription

4. AUG stands for

- a. Alanine
- b. Methionine
- c. N-formyl methionine
- d. Glycine

5. The reason behind the anti-parallel strand of DNA is

- a. Hydrogen bond
- b. Ionic bond
- c. Phosphodiester bond
- d. Disulphide bond

6. In a transcription unit, the promoter is located towards

- a. 5'end of the structural gene
- b. 3'end of the structural gene
- c. 5'end of the template strand
- d. 3'end of the template strand

7. The primer in DNA replication is

- a. Small ribonucleotide polymer
- b. Helix destabilizing protein
- c. Small deoxyribonucleotide polymer
- d. Enzyme joining nucleotides of new strands

8. Genetic information is transferred from nucleus to cytoplasm through

- a. RNA
- b. Anticodon
- c. DNA
- d. Lysosomes

9. The enzyme involved in transcription

- a. DNA Polymerase I
- b. DNA Polymerase III
- c. RNA Polymerase
- d. DNA Polymerase II

10. Non-sense codons participate in

- a. Releasing t-RNA from polynucleotide chain
- b. Formation of unspecified amino acids

- c. Terminating message of gene-controlled protein synthesis
- d. Conversion of sense DNA into non-sense DNA

Assertion Reason Questions

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

1. **Assertion:** Only the sense strand of DNA is copied into mRNA.

Reason: The antisense strand plays a role in replication.

2. **Assertion:** Sickle-cell haemoglobin has a valine in place of glutamic acid at position 6 in the β polypeptide chain.

Reason: Sickle-cell anaemia is expressed only in homozygous recessive state.

3. Assertion : In a DNA molecule, A-T rich parts melt before G-C rich parts.

Reason : In between A and T there are three H-bond, whereas in between G and C there are two H-bonds.

4. Assertion: The two chains of DNA have anti-polarity.

Reason: In one chain of DNA, ribose sugar at 5' end consists of a free phosphate moiety while at the other end the ribose has a free 3' OH group.

5. Assertion: Adenine cannot pair with cytosine.

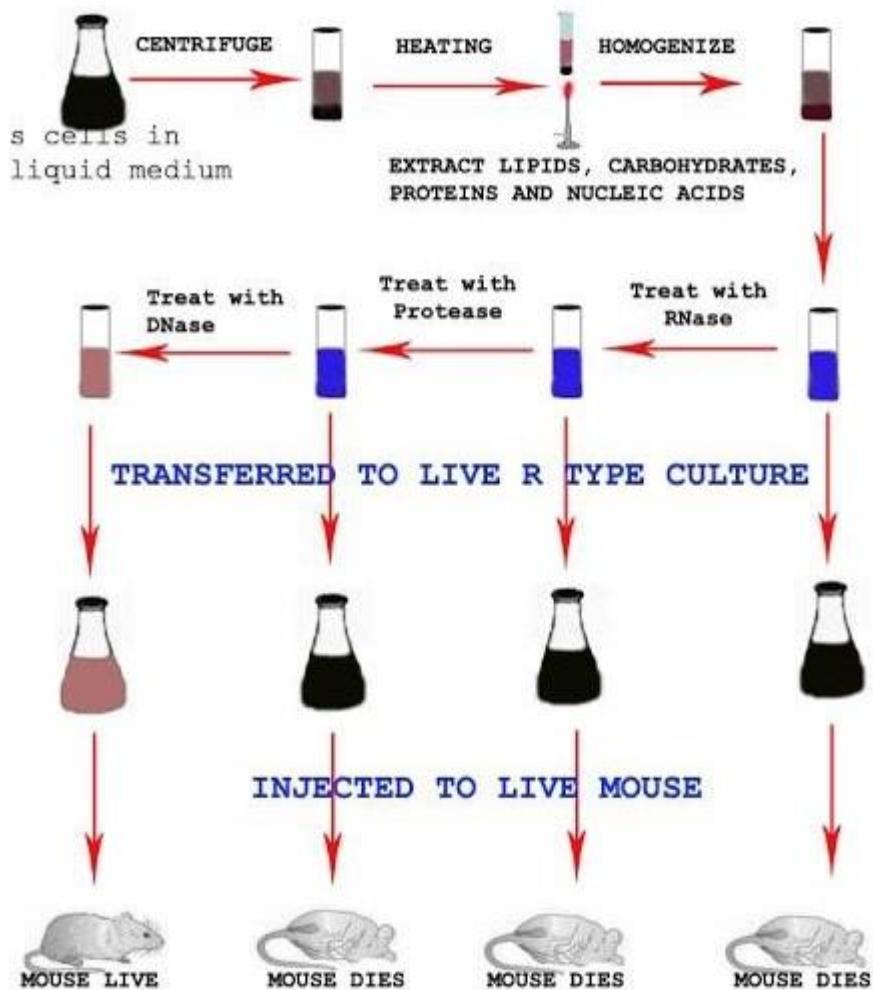
Reason: Adenine and cytosine do not have a perfect match between hydrogen donor and hydrogen acceptor sites. Hence, they cannot pair.

Case Study

Read the following and answer any four questions from (i) to (iv) given below:

The discovery of nuclein by Meischer and the proposition for principles of inheritance by Mendel were almost at the same time, but that the DNA acts as a genetic material took long to be discovered and proven. By 1926, the quest to determine the mechanism for genetic inheritance had reached the molecular level. Previous discoveries by Gregor Mendel, Walter Sutton, Thomas Hunt Morgan and numerous other scientists had narrowed the search to the chromosomes located in the nucleus of most cells. But the question of what molecule was actually the genetic material, had not been answered.

Oswald Avery, Colin MacLeod and Maclyn McCarty (1933-44) Worked to determine the biochemical nature of ‘transforming principle’ in Griffith’s experiment. The diagram given below is depicting the experiment done by these 3 scientists to establish the biochemical nature of the transforming principle.



- (i) The first significant effort to identify the genetic material was done by:
- (ii) The biochemical nature of the transforming principle was established by:
- (iii) What is the role of RNAase in the experiment given above?
- (iv) Which among the following case is causing the transformation of R-strain bacteria into S-strain bacteria?

2-MARK QUESTIONS

1. Differentiate between template strand and coding strand?
2. Differentiate between Euchromatin and Heterochromatin
3. Represent a polynucleotide chain diagrammatically and mark clearly in it the 3' and 5' end?
4. What are the criteria needed to call a molecule as genetic material?
5. Name the Bacteria used by a) Meselson and Stahl b) Griffith
6. RNA is the first genetic material. Justify the statement
7. Expand BAC and YAC. Where are they used?
8. How is protein synthesis initiated in a cell?
9. A mutation occurred which did not affect the protein synthesis of the organism in which it occurred. How did this happen? Explain its importance.
10. List the two essential roles of ribosome during translation.

11. Differentiate between Continuous and Discontinuous DNA synthesis
12. Give the differences between Codon and Anticodon.
13. Name the experimental organism of Meselson and Stahl. Why did they select N15 isotope of Nitrogen for their experiment?
14. (a)Describe clover leaf model of tRNA with diagram.
(b)RNA is less stable than DNA. Explain why?
- 15.Three enzymes required for metabolism of lactose, what would happen to the machinery of the operon if mutation occur in z-gene.
16. 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 this mutation.

3-MARK QUESTIONS

- 1.The base sequence of one of the strands of DNA is ATG CTC GAT
 - a) Give the base sequence of the complementary strand.
 - b) Categories these bases using their full names.
 - c) What holds these base pairs together?
- 2.What is a nucleosome? Draw its structure and explain its importance in stability of a cell?
- 3.Enumerate the goals of HGP.
- 4.Explain how does the hnRNA becomes the mRNA.
- 5.Explain the process of splicing, capping and tailing which occur during transcription in Eukaryotes.
- 6.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.
- 7.Two claimant fathers file a case against a lady claiming to be the father of her only daughter. How could this case be settled identifying the real biological father?
- 8.Explain the functions of the following
 - a) Ligase
 - b) DNA polymerase
 - c) DNA dependent RNA polymerase
- 9.Define the following terms – Bioinformatics, ESTS, Sequence Annotation, Polymorphism, Genetic code, Replication.
- 10.Compare between the behavior of Chromosome and gene. Give at least three points.
- 11.How did Avery, Macleod and McCarty conclude that DNA could be the hereditary material.
12. A) Which two approaches were used for Human Genome Project? Explain.
B) G A C C C T
G T C C C T

5-MARK QUESTIONS

- 1.Give the salient features of DNA double helical structure. How does this structure contribute to the stability and complementarity of DNA?
- 2.What is meant by semi conservative replication? How did Meselson and Stahl prove it experimentally?
- 3.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.
- 4.State salient features of genetic code.
- 5.Describe the process of transcription of mRNA in an eukaryotic cell.
- 6.Describe the various steps involved in the technique of DNA fingerprinting.

7. The genetic codon is a triplet.
- This above truth was worked out by some eminent scientists. Name them.
 - Which enzyme helped in this process and How?
 - What are the salient features of genetic code?
8. Diagrammatically explain the experiments which helped prove-
- Transforming principle is DNA
 - DNA replicates semi conservatively. Also name the scientists involved.
9. (a) How did Griffith explain the transformation of R strain (non-virulent) bacterial into S strain (virulent)?
- (b) Explain how MacLeod, McCarty and Avery determined the biochemical nature of the molecule responsible for transforming R strain bacteria into S strain bacteria.
-

SYNOPSIS
CHAPTER 7
EVOLUTION

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

Chemical evolution: Formation of biomolecules preceded the appearance of the first cellular forms of life.

Evolution of earth

- The universe is very old – almost 20 billion years old.
- Huge clusters of galaxies comprise the universe.
- Galaxies contain stars, clouds of gas and dust.
- The Big Bang theory attempts the singular huge explosion unimaginable in physical terms.
- The universe expanded and hence, the temperature came down.
- Hydrogen and Helium formed.

- The gases condensed under gravitation and formed the galaxies of the present-day universe.
- In the solar system of the Milky Way galaxy, earth was supposed to have been formed about 4.5 billion years back.

Conditions in the primitive earth

- There was no atmosphere on early earth.
- Water vapor, methane, carbon dioxide and ammonia released from molten mass covered the surface.
- The UV rays from the sun broke up water into Hydrogen and Oxygen and the lighter H₂ escaped.
- Oxygen combined with ammonia and methane to form water, CO₂ and others.
- The ozone layer was formed. As it cooled, the water vapor fell as rain, to fill all the depressions and form oceans.
- Life appeared 500 million years after the formation of earth, i.e., almost four billion years back

(i) Theory of panspermia

This theory states that units of life called spores were transferred to different planets including earth.

(ii) Theory of spontaneous generation

- Theory states that life came out of decaying and rotting matter like straw, mud.
- Louis Pasteur disproved the theory by careful experimentation demonstrated that life comes only from pre-existing life.
- He showed that in pre-sterilized flasks, life did not come from killed yeast while in another flask open to air, new living organisms arose from ‘killed yeast’.

Oparin and Haldane theory

- Oparin of Russia and Haldane of England proposed that the first form of life could have come from pre-existing non-living organic molecules like RNA, protein, etc.
- Formation of life was preceded by chemical evolution,
- Chemical evolution is formation of diverse organic molecules from inorganic constituents.
-

The experiment conducted to support the Oparin and Haldane theory

- S.L. Miller created conditions of primitive earth in a laboratory scale.
- He created electric discharge in a closed flask containing CH₄, H₂, NH₃ and water vapor at 800 °C.
- He observed formation of amino acids.
- In similar experiments others observed, formation of sugars, nitrogen bases, pigment and fats.

Theory of biogenesis

- The first form of life arose slowly through evolutionary forces from non-living molecules 3 billion years back.
- They would have been giant molecules (RNA, Protein, Polysaccharides, etc.).
- These capsules reproduced their molecules.
- These were probably single cells.
- All life forms were in water environment only.

The theory of special creation.

This theory has three connotations.

- One, that all living organisms (species or types) that we see, today were created as such.
- Two that the diversity was always the same since creation and will be the same in future also.
- Three, that earth is about 4000 years old.

Theory of natural selection

- There has been gradual evolution of life forms.
- Any population has built in variation in characteristics.
- Those characteristics which enable some to survive better in natural conditions would outbreed others that are less-endowed to survive under such natural conditions.
- Those who are better fit in an environment, leave more progeny than others.
- These, therefore, will survive more and hence are selected by nature. He called it natural selection and implied it as a mechanism of evolution.

Evidence for evolution of life forms

Paleontological evidences -

- Fossils are remains of hard parts of life-forms found in rocks.
- Rocks form sediments one over the other during the long history of earth.
- Different-aged rock sediments contain fossils of different life-forms who probably died during the formation of the sediment.
- Some of them appear similar to modern organisms and they represent extinct organisms (e.g., Dinosaurs).
- A study of fossils in different sedimentary layers indicates the geological period in which they existed.
- The study showed that life-forms varied over time and certain life forms are restricted to certain geological time-spans.
- Hence, new forms of life have arisen at different times in the history of earth.
- All this is called paleontological evidence.

Comparative anatomy and morphology shows similarities and differences among organisms.

Homologous organs – Divergent Evolution

- Whales, bats, Cheetah and human share similarities in the pattern of bones of forelimbs.
- These forelimbs perform different functions in these animals, but they have similar anatomical structure.
- They have humerus, radius, ulna, carpals, metacarpals and phalanges in their limbs.
- Hence, in these animals, the same structure developed along different directions due to adaptions to different needs and they do different functions.
- This is called divergent evolution and these structures are called homologous.
- Homology indicates common ancestry.
Other examples are vertebrate hearts or brains.
- In plants, the thorn and tendrils of Bougainvillea and Cucurbita represent homology.

Analogous organs – Convergent Evolution

- Analogous organs are not anatomically similar structures, but they perform similar functions.
- Analogous structures are a result of convergent evolution.
- Different structures evolving for the same function and hence having similarity.
Examples:
 - Wings of butterfly and of birds.
 - The eye of the octopus and of mammals.
 - The flippers of Penguins and Dolphins.

Observation supporting evolution by natural selection

- Before industrialization set in, it was observed that there were more white-winged moths on trees than dark-winged or melanized moths in some parts of England.
- Thick growth of almost white-colored lichen covered the trees and, in that background, the white winged moth survived.
- But the dark-colored moth was picked out by predators.
- After industrialization, i.e., in 1920, there were more dark-winged moths in the same area, as the tree trunks became dark due to industrial smoke and soots.
- Under this condition the white-winged moth did not survive due to predators, dark-winged or melanized moth survived.

Lichens can be used as industrial pollution indicators why?

They will not grow in areas that are polluted.

Adaptive radiation

- In Galapagos Islands Darwin observed different varieties of small black birds called Finches. All these varieties evolved on the island itself.
- From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches.
- This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.
- Another example is Australian marsupials. A number of marsupials, each different from the other evolved from an ancestral stock.
- When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), one can call this convergent evolution.

Evolution by natural selection

- The essence of Darwinian theory about evolution is natural selection.
- The rate of appearance of new forms is linked to the life cycle or the life span.

Nature selects for fitness.

- Fitness is based on characteristics which are inherited.
- Fitness is the result of the ability to adapt and get selected by nature.
- Branching descent and natural selection are the two key concepts of Darwinian Theory of Evolution.
- Natural resources are limited, populations are stable in size except for seasonal fluctuation.

- Members of a population vary in characteristics even though they look superficially similar, most of variations are inherited.
- Population size will grow exponentially if everybody reproduced maximally.
- Population sizes in reality are limited, means that there had been competition for resources. Only some survived and grew at the cost of others that could not flourish.
- Variations, which are heritable, and which make resource utilization better for few will enable only those to reproduce and leave more progeny.

Mutations

- Mutations – large difference arising suddenly in a population.
- Mutations are random and directionless.
- Mutation caused speciation and hence called it saltation (single step large mutation).
- Darwinian variations are small and directional.
- Evolution for Darwin was gradual.

HARDY-WEINBERG PRINCIPLE

- Hardy-Weinberg principle says that allele frequencies in a population are stable and is constant from generation to generation.
- The gene pool (total genes and their alleles in a population) remains a constant. This is called genetic equilibrium.
- Sum of all the allelic frequencies is 1.
- In a diploid, p and q represent the frequency of allele A and allele a.
- The frequency of AA individuals in a population is simply p^2 .
- An allele A with a frequency of p appears on both the chromosomes of a diploid individual is simply the product of the probabilities, i.e., p^2 .
Similarly of aa is q^2 , of Aa $2pq$. Hence, $p^2+2pq+q^2=1$.
- Disturbance in genetic equilibrium, or Hardy- Weinberg equilibrium, i.e., change of frequency of alleles in a population would then be interpreted as resulting in evolution.

Five factors are known to affect Hardy-Weinberg equilibrium.

- These are gene migration or gene flow, genetic drift, mutation, genetic recombination and natural selection.

Migration

- When a section of population migrates to another place, gene frequencies change in the original as well as in the new population.
- New genes/alleles are added to the new population and these are lost from the old population. There would be a gene flow if this gene migration, happens multiple times.

Genetic drift

Sometimes, new genes/alleles are added to the new population and these are lost from the old population.

If this occurs by chance, it is called genetic drift.

Sometimes the change in allele frequency is so different in the new sample of population that they become a different species.

The original drifted population becomes founders and the effect is called founder effect.

Natural selection

- Pre-existing advantageous mutations when selected will result in observation of new phenotypes. This would result in Speciation.
- Natural selection is a process in which heritable variations enabling better survival are enabled to reproduce and leave greater number of progeny.
- Variation due to mutation or variation due to recombination during gametogenesis, or due to gene flow or genetic drift results in changed frequency of genes and alleles in future generation.
- Natural selection can lead to stabilization (in which more individuals acquire mean character value), directional change (more individuals acquire value other than the mean character value) or disruption (more individuals acquire peripheral character value at both ends of the distribution curve).

Brief account of evolution

- About 2000 million years ago, Non-cellular aggregates of giant macromolecules evolved into cells with membranous envelop.
- Thus, the first cellular forms of life appeared on earth.
- Slowly single-celled organisms became multi-cellular life forms. By the time of 500 mya, invertebrates were formed and active.
- Sea weeds and few plants existed probably around 320 mya.
- Jawless Fish with stout and strong fins that could move on land and go back to water evolved around 350 mya.
- These animals called lobefins evolved into the first amphibians that lived on both land and water.
- These were ancestors of modern day frogs and salamanders.
- The amphibians evolved into reptiles.
- They laid thick shelled eggs which do not dry up in sun unlike those of amphibians.
- In the next 200 million years or so, reptiles of different shapes and sizes dominated on earth.
- Some of these land reptiles went back into water to evolve into fish like reptiles probably 200 mya (e.g. Ichthyosaurs).
- The land reptiles were, of course, the dinosaurs.
- The biggest of them, i.e., Tyrannosaurus rex was about 20 feet in height and had huge fearsome dagger like teeth.
- About 65 mya, the dinosaurs suddenly disappeared from the earth. The climatic changes killed them.
- Some say most of them evolved into birds. The truth may live in between. Small sized reptiles of that era still exist today.

- When reptiles came down mammals took over this earth.
- The first mammals were like shrews. Their fossils are small sized
- Mammals were viviparous and protected their unborn young inside the mother's body.
- Mammals were more intelligent in sensing and avoiding danger at least.

Origin and evolution of man

- About 15 mya, primates called Dryopithecus and Ramapithecus were existing.
- They were hairy and walked like gorillas and chimpanzees.
- Ramapithecus was more man-like while Dryopithecus was more ape-like.
- About 3-4 mya, man-like primates walked in eastern Africa, were not taller than 4 feet but walked up right.
- Two mya, Australopithecines probably lived in East African grasslands.
- They hunted with stone weapons but essentially ate fruit.
- Some of the creatures were different and they were the first human-like being the hominid and was called Homo habilis.
- Their brain capacities were between 650-800cc. and they probably did not eat meat.
- Next stage, i.e., Homo erectus about 1.5 mya.
- Homo erectus had a large brain around 900cc.
- Homo erectus probably ate meat.
- The Neanderthal man with a brain size of 1400cc lived in near east and central Asia between 1,00,000-40,000 years back.
- They used hides to protect their body and buried their dead.
- Homo sapiens arose in Africa and moved across continents and developed into distinct races.
- During ice age between 75,000-10,000 years ago modern Homo sapiens arose. Pre-historic cave art developed about 18,000 years ago.
- Agriculture came around 10,000 years back and human settlements started.

CHAPTER 7

EVOLUTION

1-MARK QUESTIONS-MCQ's

1. The force that initiates evolution is
 - a. Variation
 - b. Mutation
 - c. Extinction
 - d. Adaptation
2. _____ is a vestigial organ
 - a. Intestinal villi
 - b. Papillae
 - c. Vermiform appendix
 - d. None of the above
3. The earliest geological time period among the following is
 - a. Cambrian
 - b. Permian
 - c. Jurassic
 - d. Quaternary
4. The experiment that simulated conditions thought to be present on the early earth
 - a. Hershey–Chase experiment
 - b. Geiger–Marsden experiment
 - c. Miller–Urey experiment
 - d. Schiehallion experiment
5. Example of a homologous organ
 - a. The arm of a human, wing of a bird
 - b. Wing of an insect, wing of a bird
 - c. Leg of a dog, leg of a spider
 - d. None of the above
6. Primordial soup is a set of hypothetical conditions on ancient earth first proposed by_____
 - a. Dmitri Ivanovsky
 - b. Alexander Oparin
 - c. Dmitry Anuchin
 - d. Nikolay Shatsky
7. Which condition can be explained by Lamarckism?
 - a. How giraffes got their long neck
 - b. How humans lost their tail
 - c. How humans became bipedal
 - d. All of the above
8. Observation of species on _____ heavily inspired Darwin's theory of evolution.
 - a. Ilha da Queimada Grande
 - b. Guatemala
 - c. Faroe Islands
 - d. Galapagos Islands
9. The last common ancestor of humans is

- a. Pan troglodytes
 - b. Homo neanderthalensis
 - c. Lemuroidea
 - d. Dromaeosaurus
10. An example of convergent evolution is
- a. Wing of Hawkmoths, the wing of hawks
 - b. Teeth of domestic dog, teeth of a wolf
 - c. Wings of Geospiza magnirostris, wings of Geospiza fortis
 - d. None of the above

ASSERTION REASON

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- (c) If Assertion is true but Reason is false.
- (d) If both Assertion and Reason are false.

1. Assertion : According to big-bang hypothesis about 20 billion years ago universe was a big ball of only neutrons.

Reason : Movement of these particles is known to generate tremendous heat which caused explosion due to temperature and pressure changes.

2. Assertion : Big-bang theory is based on studies of Sir James Jeans.

Reason : He gave the theory of steady state.

3. Assertion : Milky way is the galaxy in the universe.

Reason : Our Earth is part of milky way.

4. Assertion : The primitive atmosphere was reducing once i.e., without oxygen.

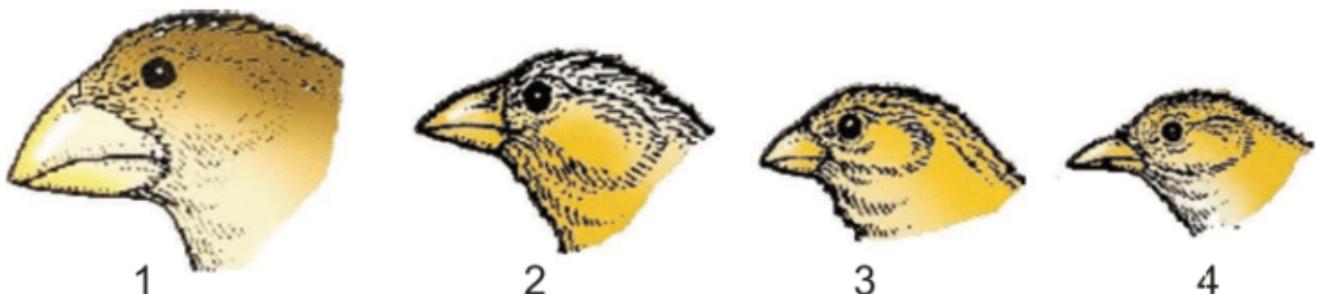
Reason : In the primitive atmosphere, oxygen was involved in forming ozone.

5. Assertion : Organic compounds first evolved in earth required for origin of life were protein and nucleic acid.

Reason : All life forms were in water environment only.

CASE STUDY

Darwin found the varieties of finches that travelled to Galapagos Islands and observed variations in them.



- (i) What role does an individual organism play as per Darwin's theory of natural selection?
- (ii) How did Darwin explain the existence of different varieties of finches on Galapagos Islands?
- (iii) What is "fitness of an individual" according to Darwin?

2-MARK QUESTIONS

1. Explain briefly the composition of Earth's atmosphere 3000 million years ago.
2. Mention any four details that can be inferred about organisms from their fossils.
3. Birds have evolved from reptiles. How does paleontology provide evidence in support of the above statement?
4. Are the following organs homologous or analogous? Why?
5. Describe briefly the differences between geographical isolation and reproductive isolation of two populations of an organism.
6. How did Louis Pasteur demonstrate that life comes only from preexisting life?
7. What does the following picture show and prove? Where were they found?
8. How does the theory of Panspermia explain Origin of Life?
9. Differentiate between gene flow and genetic drift?
10. Why lobefins are considered as ancestors of modern-day amphibians?
11. Amongst tea tendrils, opuntia spines, lemon thorns, rose prickles and cucurbit tendrils, which ones are homologous structures? Why do you call them homologous?
12. What kind of evidence is afforded by the Darwin's finches in support of organic evolutions? 13. Why is man considered as more superior animal?
14. Distinguish between convergent and divergent evolution giving one example of each

3-MARK QUESTIONS

1. Explain how industrialization in England have its effect on natural selection of moths?
2. Any pesticide manufactured is effective only for a limited period. Explain how natural selection plays a role in this with suitable examples.
3. Mention and elucidate on the three connotations linked with the 'Theory of Special creation'.
- 4.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?
5. Explain the following observations-
 - a) Similarity in proteins and genes of diverse organisms b) Localization of marsupials on Australian continent.
6. What is selection? How is artificial selection different from natural selection? Give one example each from plants and animals where artificial selection has operated.
7. Oparin and Haldane proposed a new theory of origin of life.
 - (a) How did life form according to them?
 - (b) What condition did they propose earth had which led to origin of life?
 - (c) How did Stanley Miller provide evidence for their theory of origin of life?
8. How did Louis Pasteur successfully demolish the popular theory of spontaneous generation? What were his conclusions?

5-MARK QUESTIONS

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

2. Is evolution a ‘process’ or the result of a ‘process’? Discuss.
3. 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.
4. 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?
- (iv) Name two products formed.
6. Comment on the evolution of man the most successful species on planet Earth.
- 7.a. What is Hardy Weinberg’s Equilibrium? a. Explain mathematically.
- b. Describe various factors that affect Hardy-Weinberg equilibrium.
8. Describe Miller and Urey experiment, along with the products obtained. What is the significance of this experiment?

SYNOPSIS
CHAPTER- 8
HUMAN HEALTH & DISEASES

DISEASE
CAUSUAL ORGANISM
MODE OF TRANSMISSION
SYMPTOMS
PREVENTIVE MEASURE
Typhoid (Bacterial)

Salmonella typhi

- Through contaminated water and food
- Sustained high fever, weakness, stomach pain, constipation, headache, loss of appetite.
- In severe cases intestinal perforation and death may occur.
- Consumption of clean drinking water, food& fruits.
- Public hygiene like proper disposal of waste /excreta, periodic cleaning and disinfection of water reservoir. (water borne diseases precautions)
- Can be detected by Widal test.

Pneumonia (Bacterial)-Streptococcus pneumoniae/ Haemophilus influenzae

Through air.

Fever, chills, cough and headache, severe problems in respiration

Above measures, avoid contact with infected persons.

(precautions for air borne disease)

Filariasis-Wuchereria Bancrofti

- Through contaminated water and food.
- Transmitted by female anopheles mosquito
- Chronic inflammation of lymphatic vessels in lower limbs, genital organs may result in gross deformities.
- Avoid stagnation of water, regular cleaning of house hold coolers ,use of mosquito nets, spray insecticide in ditches, use wire mesh on windows and doors

Ringworm-Micromsporum / Trichophyton/ Epidermophyton

- Through soil, by using same towels, clothes and even the comb of infected individuals.
- Dry scale lesions on various parts of body, mainly they are seen in the groin and between toes.
- Avoid using other Person's clothes.
- Precautions of insect borne diseases in towel, clothes and comb

Common cold-Rhino viruses

- Through air -inhaling droplets from cough and sneeze or through nasal congestion and discharge, sore throat, hoarseness, cough.
- Above measures, avoid contact with infected persons, contaminated objects like pens, books, etc.

Malaria-Plasmodium. vivax.

- Chill, high fever recurring every 3-4 days headache, tiredness
- Precautions of insect borne diseases.

Amoebiasis-Entamoeba histolytica

- House flies.
- Contaminated food and water.
- Constipation, abdominal pain, cramps, stools with mucous and blood clots
- Precautions of water borne diseases

Dengue- (Dengue virus)Female Aedes mosquito

- High fever, head ache, muscle pain, joint pain and rashes.
- Precautions of insect borne diseases

Chikungunya - (Alpha virus)-Aedes aegypti

- Rashes on limbs, arthritis affecting joints, headache, high fever
- Precautions of insect borne diseases

Life Cycle of Malarial parasite

- Sporozoites enter from mosquito into human body – reach human liver-asexual reproduction takes place in liver cells. And releases the cells into red blood cells ---parasites reproduce asexually in RBC and cause fever and other symptoms –sexual stages takes place in RBC---- gametocytes develop in RBC ----this gametocytes enters into female mosquito when it bites infected person ---fertilization of gametocytes takes place in the intestine of mosquito---zygote divide and produce infective stage called sporozoites and migrate to salivary glands----this enters into human body
- Human body ---sporozoites
- Asexual reproduction in liver and RBC.
- Sexual stages to produce gametocytes –RBC Mosquito -----gametocytes.
- Fertilization in intestine of mosquito Zygote divides to form sporozoite

CHAPTER 8

HUMAN HEALTH & DISEASES

1 MARK QUESTIONS-MCQ's

1. Immunosuppressants such as _____ prevent transplanted organs from being rejected in recipients.
 - a. Thrombin
 - b. Cyclosporine
 - c. Aspirin
 - d. None of the above

2. Both B & T lymphocytes are produced in the bone marrow; however, only the T lymphocytes travel to the _____ and mature there.
- Spleen
 - Thymus
 - Pituitary gland
 - Adrenal gland
3. The _____ is at its largest in children, but with the onset of puberty, it eventually shrinks and gets replaced by fat.
- Thymus
 - Hypothalamus
 - Parathyroid gland
 - None of the above
4. Ascaris lumbricoides is a species of parasitic roundworm that lives in _____
- Humans
 - Grasshoppers
 - Pigs
 - None of the above
5. Which of the following diseases has been eradicated?
- Smallpox
 - Rinderpest
 - Polio
 - All the above
6. A form of injury that causes the premature death of nearly all cells in a tissue or organ through autolysis is called _____
- Neurosis
 - Necrosis
 - Apoptosis
 - Cellular senescence
7. Hypochondria is also termed as:
- Health anxiety
 - Sleep apnea
 - Hypnagogic
 - Narcolepsy
8. The immune system comprises:
- Humoral and fibrous systems
 - Humoral and Cell-mediated systems
 - Antigens
 - Lymphocyte

9.Which of the following is a viral disease?

- a. Diphtheria
- b. Filariasis
- c. Leprosy
- d. Influenza

10.Carcinoma arises from the

- a. Epithelial cells
- b. Bone Marrow
- c. Pigment containing Cells
- d. None of the above

2 MARKS QUESTIONS

1. Name four types of antibodies present in human body?

2. How do cancer cells react to contact inhibition?

3. What is the role of histamine in inflammatory response? Name few drugs which reduce the symptoms of allergy.

4. How do youngsters get motivated towards use of drugs?

5. With repeated usage of drugs why the intake of drugs increases with time?

6. Name the diagnostic tests for Cancer

7. Which type of barriers are the following:

- (a) MALT (b) neutrophils
- (c) Interferons (d) HCl in stomach.

8. What is Passive immunity? Give two examples to support your answer.

9. Recently Indian Weightlifters have been charged of taking banned steroids. Why do sportsperson take these steroids? Mention two ill effects of such drugs on females

10. State the difference between malignant and benign tumor.

12. Lymph nodes are secondary lymphoid organs. Describe the role of lymph nodes in our immune response.

13. A boy had influenza. He got infection due to door handle use by infected students of same class. Mention it type of transmission of pathogen.

14. Explain Cell mediated and Humoral Immune responses in detail. Draw well labeled diagram of Immunoglobulin and explain its structure.

3 MARK QUESTIONS

1. What is composition of immune system? What is its significance?

2. What is the role of lymphocytes in the immune system? Give the differences between B-Lymphocytes and T-Lymphocytes.

3. a) How are autoimmune diseases different from immunodeficiency diseases?

 b) State the use of following enzymes acids produced by microbes:

- (i) Cyclosporin A (ii) Streptokinase

 (c) Why are nucleopolyhydrases used in IPM programmed?

4. a) What treatment is given to a person bitten by a snake?

- b) Which type of immunization is it? Why?
c) Which type of cells is involved in this type of immunization?
5. (a) Name the primary lymphoid organ of the body?
(b) Why are they called primary?
(c) As a secondary lymphoid organ what is the function of Peyer patch in Intestine?
(d) Why lymph nodes get inflated during infection?
6. What are biological response modifiers? Explain with a suitable example.
7. 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
8. A person has been diagnosed to be HIV positive. (i) Name the test which the person has undergone.
(ii) Write the full name of the pathogen involved and describe its structure. (iii) Which particular cells of this person are likely to get destroyed?
9. What do you mean by withdrawal syndrome? Write the side effects of the use of anabolic steroids in males.
10. Identify the chemical structure. Give the scientific name of the plant from which it is obtained. Which two plant parts are used to extract this compound? Name the body system most affected by this compound.

5 MARK QUESTIONS

1. What is the role of lymphoid organs in human being? Name primary and secondary lymphoid organs and mention three functions.
2. Give schematic representation of life cycle of HIV.
3. Name causative organisms of malaria fever. Discuss the life cycle of Plasmodium inside human body.
4. Complete the following with a common answer
 - a. Lymphoid organs, Tissue cells and antibodies b. Antihistamines, adrenalin and steroids
 - c. Dust, pollen grains and animal dung. d. X-rays, gamma rays and UV rays
 - e. Papaver somniferum, Cannabis sativa and Erythroxylum coca.

5. What are the antibodies? Explain its structure with the help of diagram

6. Answer the following with respect to Cancer.
- (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.

7. The pathogen of a disease depends on RBCs of human for growth 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.

8. The immune system of a person is suppressed. 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.

9. Fill up the blanks

- a) Few cellular barriers _____
- b) Two types of lymphocytes_____, _____.
- c) Antibody mediated response _____.
- d) Cell mediated response_____.
- e) Colostrum provides_____ -immunity
- f) Drugs that reduce symptoms of allergy_____.
- g) Two chemicals that released during cause allergy_____, _____.
- h) Examples of passive immunization_____.
- i) Transmission of HIV virus is by_____
- j) Biological response modifiers used in cancer treatment_____

10.. Go through the statements and complete the sequence.

- a) Mosquito bites a healthy human and injects Sporozoites.
- b) Sporozoites reach the a) ----- through b) -----
- c) Reproduces c) ----- burst the cells and release into blood.
- d) Enter the d) -----
- e) Reproduce asexually and release by bursting.
- f) The cell releases _____
- g) ----- responsible for fever
- h) Some of them form ----- that are picked by mosquito when it bites.

ASSERTION REASON

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1. Assertion: Streptococcus pneumoniae and Haemophilus influenzae are responsible for causing infectious diseases in human beings.

Reason: A healthy person acquires the infection by inhaling the droplets/aerosols released by an infected person.

2. Assertion : Paroxysms are regular and daily in Quotidian malaria.

Reason : Recurrence of fever is after 48 hours if the infection is caused by Plasmodium malariae.

3. Assertion: There is no chance of malaria to a man on the bite of male Anopheles mosquito.

Reason: It carries a non-virulent strain of Plasmodium.

4. Assertion : Plasmodium vivax is responsible for malaria.

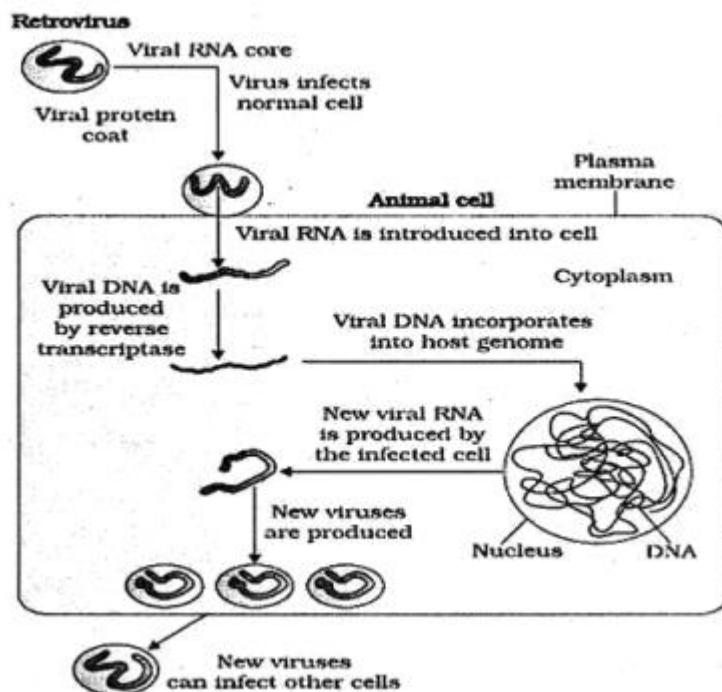
Reason : Malaria is caused by polluted water.

5. Assertion : Escherichia coli, Shigella sp. and Salmonella sp. are all responsible for diarrhoeal diseases.

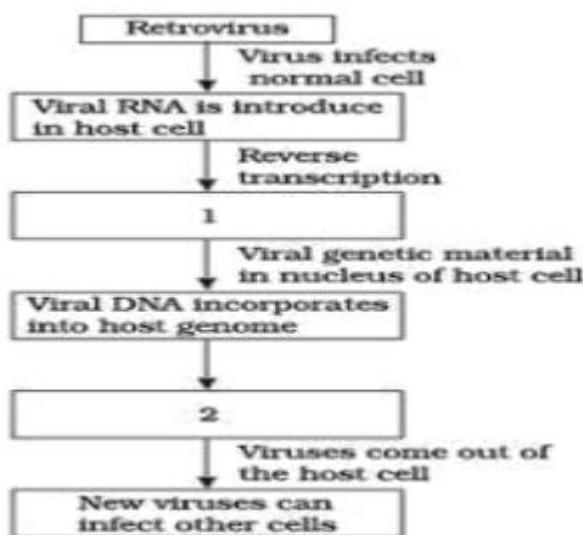
Reason : Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids and electrolytes should be ensured.

CASE STUDY

1. OBSERVE THE FIGURE The diagram shows replication of the retrovirus in the host. Note and answer the following questions.



(a) Fill in the missing data in boxes labelled 1 & 2.



- (b) Why is it named as retrovirus?
- (c) While the virus is being replicated and released, does the infected cell survive?
- (d) Why does immunity of an HIV infected person decrease even though the viral infected cell survives?

2. Tarun was one of the best boys in the class. In spite of his efforts he was not doing well in class XI. His father wanted him to qualify for medical sciences. He got frustrated with his results and resorted to drugs. He started misbehaving with parents and friends in school. His friends started neglecting him. The school authorities counselled Tarun but to no effect.

His parents were upset and took him to a rehabilitation centre. After a few months he came back recovered.

- a) What values did the Principal reflect through his initiative?
- b) What is drug abuse?
- c) Name some commonly abused drugs and their source.
- d) What should be the attitude of his parents after his return?

3. Joy loves to play football and was selected as captain of the school team for the district level tournament. He also does social work. He attended a blood donation camp to donate blood and came to know that he was HIV positive. He lost interest in games and refused to play or study. He started counting his days. He remained absent from school for a long time. The Biology teacher visited his house and counselled him. Joy was back at school and also played the tournament.

- a) What sense of responsibility did the Biology teacher exhibit?
- b) A person detected to be HIV positive should be isolated in the society? Do you agree? Why/ Why not?
- c) How is AIDS not spread?

SYNOPSIS **CHAPTER -9**

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

- Animal husbandry is the practice of taking care and breeding domestic animals by applying scientific principles.
- The ever-increasing demand of food from animals and animal products both in terms of quality and quantity has been met by good animal husbandry practices.
- These practices include (i) management of farm and farm animals, and (ii) animal breeding. In view of the high nutritive value of honey and its medicinal importance, there has been a remarkable growth in the practice of bee-keeping or apiculture.
- Fishery is another flourishing industry meeting the ever-increasing demand for fish, fish products and other aquatic foods.
- Plant breeding may be used to create varieties, which are resistant to pathogens and to insect pests. This increases the yield of the food.
- This method has also been used to increase the protein content of the plant foods and thereby enhance the quality of food.
- In India, several varieties of different crop plants have been produced. All these measures enhance the production of food.
- Techniques of tissue culture and somatic hybridization offer vast potential for manipulation of plants in vitro to produce new varieties.
- As traditional breeding techniques failed to keep pace with demand and to provide sufficiently fast and efficient systems for crop improvement, another technology called tissue culture got developed.

- Microbes are being grown on an industrial scale as source of good protein.
- Microbes like Spirulina can be grown easily on materials like waste water from potato processing plants (containing starch), straw, molasses, animal manure and even sewage, to produce large quantities and can serve as food rich in protein, minerals, fats, carbohydrate and vitamins. Incidentally such utilization also reduces environmental pollution.

STRATEGIES FOR ENHANCEMENT IN FOOD PRODUCTION

1 MARK QUESTIONS-MCQ's

1. The process of protoplast isolation was first carried out by _____
 - Henshel
 - Bergman
 - Klercker
 - None of the above
2. Cast nets are designed to catch _____
 - Fish
 - Catla
 - Salmon
 - All of the above
3. _____ is the result of an artificial hybridization between radish and cabbage
 - Brassicaceae
 - Raphanobrassica
 - Hirschfeldia incana
 - None of the above
4. Bioenergy is obtained from _____
 - Sun
 - Coal
 - Biomass
 - Petroleum
5. Hypophysation is a technique primarily used in _____
 - Fisheries
 - Apiaries
 - Poultry
 - None of the above
6. _____ was given to cows for increasing the milk yield before being banned in 1979
 - Diethylstilbestrol
 - Estrogen
 - Progesterone
 - Destrol
7. Feedstock for biodiesel can primarily be obtained from

- a. Jatropha
 - b. Oryza
 - c. Nymphaea
 - d. None of the above
8. _____ is an instrument that helps to achieve specific temperature and pressure for scientific/medical and industrial applications.
- a. Sterilizers
 - b. Autoclave
 - c. Electrosurgical unit
 - d. None of the above
9. Which of the following are classified as a benthopelagic fish?
- a. Stargazer
 - b. Tuna
 - c. Great white shark
 - d. None of the above
10. Crossing between different breeds is called
- a. Inbreeding
 - b. Consanguinity
 - c. Out-crossing
 - d. None of the above

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- (d) If both Assertion and Reason are false.

1. Assertion: The essential methods for livestock production are breeding, weeding, feeding and heeding.

Reason: Livestock management deals with processes and systems that increase yield and improve quality of products.

2. Assertion: Hisardale is new cross breed of sheep.

Reason: It is developed by crossing Bikaneri ewe and Marino ram.

3. Assertion: Light is essential in poultry farm management.

Reason: 14-16 hours of light including day light is required for optimum production of eggs.

4. Assertion: Beehives are kept in crop field during flowering period.

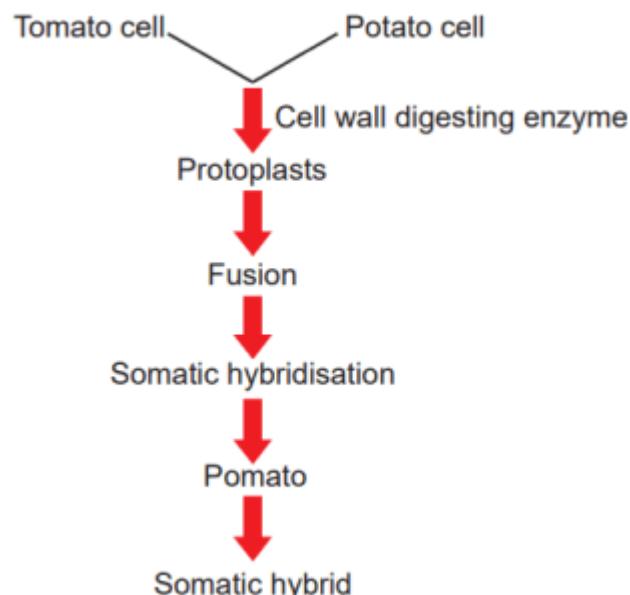
Reason: Bees are pollinating agents.

5. Assertion : The honey bee queen copulates only once in her life time.

Reason : The honey bee queen can lay fertilized as well as unfertilized eggs.

CASE STUDY

Given below is a flowchart for the formation of somatic hybrid, Pomato.



- (i) A certain tissue, of a plant, infected with TMV was used to obtain a new plant using tissue culture technique. Identify the technique used and reason out the possibility of obtaining a new healthy plant.
- (ii) How can pollen grains of wheat and rice which tend to lose viability within 30 minutes of their release be made available months later for breeding programmes?
- (iii) What is protoplast fusion?

2 MARK QUESTIONS

1. Explain the given statements in light of food chain.” 3 -10 kg of grain is used to produce 1 kg of meat”.
2. Knowledge of cellular totipotency is a great finding in tissue culture. Explain.
3. What are transgenic animals? Explain giving example, any four reason for producing transgenic animals.
4. Why timely detection of diseases like Syphilis, Gonorrhoea is deterred in society?
5. Write the use of following in rDNA technology.
 - (a) Ethidium bromide (b) Lac z gene
 - (c) Chilled ethanol (d) Agrobacterium tumefaciens

6. Expand MOET. Explain the procedure of this technology in cattle improvement.
7. How is inbreeding different from out breeding?
8. Why are proteins synthesized from Spirulina called Single celled Proteins? What is the significance of such a protein?
9. 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.
10. Why is germplasm collection of a crop and wild species useful in hybridization experiments?
11. Glomus forms mycorrhizal association with plants. During this the plant gets some benefits. State two of them.
12. Following are the steps in MOET programme for herd improvement in which a cow has been administered hormones with FSH like activity. Arrange steps A to D in their correct sequence.
A - Transferred to a surrogate mother.
B - It is either mated with an elite bull or artificially inseminated.
C - Fertilized eggs at 32 cell stages are recovered non-surgically.
D - It produces 6-8 eggs instead of one egg which they normally yield per cycle.

3 MARK QUESTIONS

1. How is homozygous pure live created in animal breeding?
2. What is micropropagation? Why are plants produced by this technique called somaclones?
3. Name any two food plants which are produced on commercial scale using this method
4. Biofortification is the most practical means to improve public health. Justify the statement with examples.
5. Conventional breeding is often constrained by availability of limited number of disease resistant genes. Suggest any other two methods which can be used to develop disease resistance in plants with suitable examples.
6. With an example, explain how biotechnology has been applied in each of the following.
 - i. In curing diabetes mellitus?
 - ii. In producing more nutritionally balanced milk?
7. What is meant by resistance of plants? Name few plant diseases caused by fungus, bacteria and viruses.
8. Name the following
 - a) Two high yielding varieties of wheat
 - b). Two semi dwarf varieties of rice developed in India
 - c. Plant diseases caused by bacteria and fungi
9. Fill up the following blanks
 - a) Crop variety -----
 - b) Wheat ---- Hill blunt
 - c) ----- Karan rai -----
 - d) Chilli ----- Leaf curl
 - e) ----- ----- Blight black rot
 - f) Cow pea ----- -----
10. What is meant by biofortification? What is the objective of this?
11. Conventional breeding is often constrained by availability of limited number of disease resistant genes. Suggest any other two methods which can be used to develop disease resistance in plants with suitable examples.

12. Soyabean and Taichung Native I are recently introduced crops. What is such a practice called as? Name the weed that came to India through this practice. How does the government avoid weeds and pathogens from entering the country?

5 MARK QUESTIONS

1. (i) Explain the natural and artificial methods of animal breeding. (ii) Which is better method and why?
2. Differentiate between an inbred line and a hybrid variety of crop. Explain the steps involved in the production of the hybrid variety.
3. Define the following:
i)Green revolution ii) White revolution iii) Blue revolution iv) Plant breeding v) Mutation breeding vi) SCP
4. What is meant by micro propagation, tissue culture, explants, totipotency & somoclonies?
5. Explain the main steps in plant breeding to create a new genetic variety of crop.
6. Give the important components of poultry farm and dairy farm management.

SYNOPSIS
CHAPTER 10
MICROBES IN HUMAN WELFARE

- Microbes are a very important component of life on earth. Not all microbes are pathogenic. Many microbes are very useful to human beings. We use microbes and microbially derived products almost every day.
 - Bacteria called lactic acid bacteria (LAB) grow in milk to convert it into curd. The dough, which is used to make bread, is fermented by yeast called *Saccharomyces cerevisiae*. Certain dishes such as idly and dosa, are made from dough fermented by microbes.
 - Bacteria and fungi are used to impart particular texture, taste and flavor to cheese.
 - Microbes are used to produce industrial products like lactic acid, acetic acid and alcohol, which are used in a variety of processes in the industry.
 - Antibiotics like penicillin produced by useful microbes are used to kill disease-causing harmful microbes.
 - Antibiotics have played a major role in controlling infectious diseases like diphtheria, whooping cough and pneumonia.
 - For more than a hundred years, microbes are being used to treat sewage (waste water) by the process of activated sludge formation and this helps in recycling of water in nature.
 - Methanogens produce methane (biogas) while degrading plant waste. Biogas produced by microbes is used as a source of energy in rural areas.
 - Microbes can also be used to kill harmful pests, a process called as biocontrol. The biocontrol measures help us to avoid heavy use of toxic pesticides for controlling pests.
 - There is a need these days to push for use of biofertilizers in place of chemical fertilizers. It is clear from the diverse uses human beings have put microbes to that they play an important role in the welfare of human society.
-

Chapter 10

MICROBES IN HUMAN WELFARE

1 MARK QUESTIONS-MCQ's

1. Which of these processes does not give off CO₂?
 - a. Lactate fermentation
 - b. Aerobic respiration
 - c. Alcoholic fermentation
 - d. None of the above.
2. High biological oxygen demand in a water body means _____
 - a. Water is not polluted
 - b. Water is polluted
 - c. Waterbody contains lots of lifeforms
 - d. None of the above
3. The guts of various ruminants contain _____
 - a. Acidophiles
 - b. Halophiles
 - c. Methanogens
 - d. All of the above
4. Which of the following microbes are used for the commercial production of citric acid?
 - a. Xanthomonas citri
 - b. Asparagine
 - c. Asparagus
 - d. Aspergillus
5. *Saccharomyces cerevisiae* is used primarily for
 - a. Baking
 - b. Bleaching
 - c. Biofuel
 - d. None of the above
6. *Acinetobacter baumannii* is a _____
 - a. Decomposing bacteria
 - b. Pathogenic bacteria
 - c. Nitrogen-fixing bacteria
 - d. None of the above
7. Ethanol can be produced using _____
 - a. *Saccharomyces cerevisiae*
 - b. *Escherichia coli*
 - c. *Pseudomonas syringae*
 - d. None of the above
8. *Bacillus thuringiensis* is used for

- a. Fermentation of beer
 - b. Biopesticide
 - c. Antibiotic
 - d. None of the above
9. Before antibiotics, the first commercial antibacterial available was _____
- a. Penicillin
 - b. Prontosil
 - c. Azithromycin
 - d. None of the above
10. Example of a natural insect repellent
- a. Citronella oil
 - b. Coconut oil
 - c. Linseed oil
 - d. None of the above

ASSERTION REASON

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

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

1. Assertion: Besides curdling of milk, LAB also improve its nutritional quality by increasing vitamin-B12.

Reason: LAB, when present in human stomach, check disease causing microbes.

2. Assertion: Streptococcus thermophilus increases nutritional value of milk.

Reason: Milk has lesser vitamin content than curd and yoghurt.

3. Assertion : Vitamins B2 is found in cereals, green vegetables, brewer's yeast, egg white, milk and liver.

Reason : It can be commercially produced by some yeasts.

4. Assertion : Lichen is important for chemical industries.

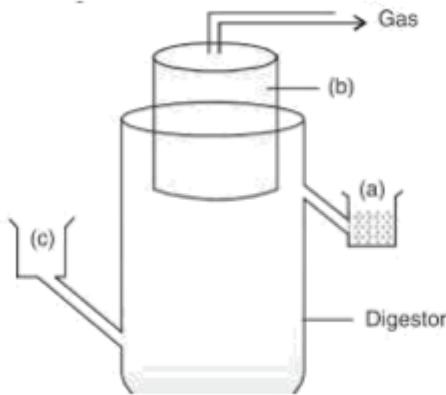
Reason : Litmus and Orcein are formed from lichens.

5. Assertion : Lichen is important for chemical industries.

Reason : Litmus and Orcein are formed from lichens.

CASE STUDY

1. Observe the given diagram and answer the questions :



- a).What is a and how is it useful to us?
- b).Name the main gases collected in b.
- c).Name the microbes present in the digester part. 3

2 MARK QUESTIONS

1. What are Methanogens? give example.
2. How do mycorrhizae function as biofertilizers? Explain with example.
3. Why biogas is called Gobar gas?
4. Expand LAB. What is its role in human body?
5. What are the objectives of Ganga action?
6. What is biogas? Name the factors that determine the type of gases produced by microbes. Name the gases produced during fermentation and sewage treatment
7. What is mycorrhiza? Give its significance. Name the main genus that form mycorrhiza
8. What is meant by biocontrol? What is the key belief of a organic farmer? How does he control pests in his field?

3 MARKS QUESTIONS

1. What are statins? Name the microorganism that produces this substance. How is it medically important?
2. Which Ministry of Govt. of India had initiated Ganga Action Plan and Yamuna Action Plan? What are the objectives of these plans?
3. cyanobacteria (Nostoc, Anabaena) are used as biofertilizers in certain crop fields. Name such one crop. Also, mention the names of two other microorganisms which perform the same function. Why is secondary treatment of sewage also called biological treatment? Explain each step.
4. What is the difference between symbiotic and free-living nitrogen fixing bacteria?
5. Which microorganism is used for the preparation of beverages.? Name the different types of beverages. explain how they are prepared.
 - i)Who was awarded Nobel prize for the discovery of the use of antibiotics
 - ii)Name the deadly diseases that can be cured by antibiotics.
 - iii)Name the fungus that produce antibiotic

6. Microbes are organisms which can be seen only under the microscopes. Give three examples to prove that microbes release gases during metabolism?
 - (a) Streptokinase is administered to patients who have suffered from myocardial infarction. What is its source and mode of action?
 - (b) What is the use of fungus Trichoderma polysporum?
 - (c) Why nucleo polyhydro virus are used in integrated pest management programmes

5 MARKS QUESTIONS

1. How are microbes useful in (i) household (ii) industries (iii) medicine iv) agriculture (v) sewage treatment.
2. Explain the working of biogas plant with the help of diagram
3. 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.
4. What is sewage? What does it contain? Explain the stages used in the sewage treatment
5. Explain the role of microbes in the production of enzymes by citing examples and give the functions of enzymes also.

CHAPTER 11

BIOTECHNOLOGY- PRINCIPLES AND PROCESSES

SYNOPSIS

- The European Federation of Biotechnology (EFB) has given a definition of biotechnology that encompasses both traditional view and modern Molecular biotechnology.
- The definition given by EFB is as follows:
- The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services'

PRINCIPLES OF BIOTECHNOLOGY

Among many, the two core techniques that enabled birth of modern Biotechnology are:

- (i) *Genetic engineering*
- (ii) Maintenance of sterile (microbial contamination-free) ambience

There are three basic steps in genetically modifying an organism —

- (i) Identification of DNA with desirable genes;
- (ii) Introduction of the identified DNA into the host;
- (iii) Maintenance of introduced DNA in the host and transfer of the DNA to its progeny.

TOOLS OF RECOMBINANT DNA TECHNOLOGY

Restriction Enzymes

- In the year 1963, the two enzymes responsible for restricting the growth of bacteriophage in *Escherichia coli* were isolated.
- One of these added Methyl groups to DNA, while the other cut DNA.
- The later was called Restriction Endonuclease Eg, EcoRI, Hind II
- Today about 900 such restriction enzymes are known and are named following international conventions. They recognize and cut palindromic sequences.
- These are then separated using the technique of gel electrophoresis.

Cloning Vectors

Plasmids and bacteriophages are used as cloning vectors. The following features are required to facilitate cloning in a vector-

- Origin of replication (ori)
- Selectable marker
- Cloning site
- Small size of vector

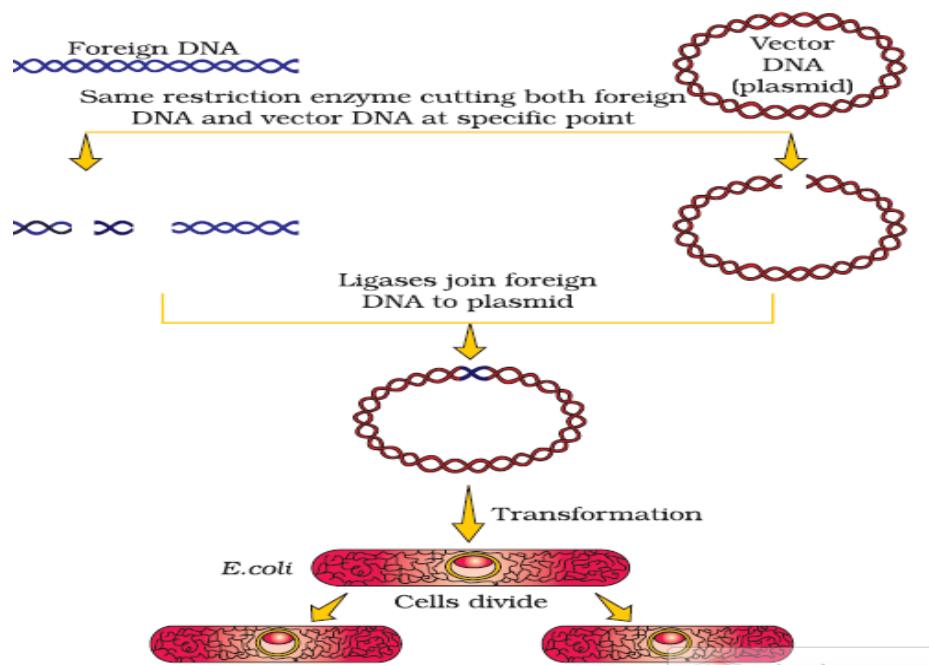
Competent hosts

- The host cell in which recombinant DNA is to be inserted has to be made competent to facilitate entry of the DNA.
- This is done by Temperature shock treatment followed by use of biotic or gene gun or microinjection or disarmed pathogen.

PROCESSES OF RECOMBINANT DNA TECHNOLOGY

- Isolation of Genetic Material (DNA)
- Amplification of Gene of interest using PCR technique
- Insertion of Recombinant DNA into host cell
- Obtaining the Foreign Gene Product

The process of Recombinant DNA technology can be diagrammatically represented as follows-



CHAPTER 11: BIOTECHNOLOGY- PRINCIPLES AND PROCESSES

1 MARK QUESTIONS-MCQ's

1. Restriction enzymes were discovered by

- a. Smith and Nathans
- b. Alexander Fleming
- c. Berg
- d. None

2. Bacteria protect themselves from viruses by fragmenting viral DNA with

- a. Ligase
- b. Endonuclease
- c. Exonuclease
- d. Gyrase

4. Southern blotting is

- a. Attachment of probes to DNA fragments
- b. Transfer of DNA fragments from electrophoretic gel to nitrocellulose sheet
- c. Comparison of DNA fragments to two sources
- d. Transfer of DNA fragments to electrophoretic gel from cellulose membrane

5. ELISA is

- a. Using radiolabelled second antibody
- b. Usage of RBCs
- c. Using compliment mediated cell lysis
- d. Addition of substrate that is converted into a coloured end product

6. The Golden Rice variety is rich in

- a. Vitamin C
- b. B-carotene and ferritin
- c. Biotin
- d. Lysine

7. The DNA fragments have sticky ends due to

- a. Endonuclease
- b. Unpaired bases
- c. Calcium ions
- d. Free methylation

8. Plasmids are used as cloning vectors for which of the following reasons?

- a. Can be multiplied in culture
- b. Self-replication in bacterial cells
- c. Can be multiplied in laboratories with the help of enzymes
- d. Replicate freely outside bacterial cells

9. The human genome project was launched in the year

- a. 1980
- b. 1973
- c. 1990
- d. 1989

10. The vaccines prepared through recombinant DNA technology are

- a. Third generation vaccines
- b. First generation vaccines
- c. Second generation vaccines
- d. None

11. Which is a genetically modified crop?

- a. Bt-cotton
- b. Bt-brinjal
- c. Golden rice
- d. All

12. PCR technique was invented by

- a. Karry Mullis
- b. Boyer
- c. Sanger
- d. Cohn

13. The first transgenic plant to be produced is

- a. Brinjal
- b. Tobacco
- c. Rice
- d. Cotton

14. RNA interference helps in

- a. Cell proliferation
 - b. Micropropagation
 - c. Cell defence
 - d. Cell differentiation
15. Which of the following is the quality of improved transgenic basmati rice?
- a. Gives high yield but no characteristic aroma
 - b. Gives high yield and is rich in vitamin A
 - c. Does not require chemical fertilizers and growth hormones
 - d. Resistant to insects and diseases
16. The first clinical application of gene therapy over a 4 year old girl was for
- a. Adenosine deaminase deficiency
 - b. Adenosine deficiency
 - c. Growth deficiency
 - d. Adenine deficiency
17. Excision and insertion of a gene is called
- a. Biotechnology
 - b. Genetic engineering
 - c. Cytogenetics
 - d. Gene therapy
18. The expression of a transgene in the target tissue is identified by a
- a. Transgene
 - b. Promoter
 - c. Enhancer
 - d. Reporter
19. _____ is used as a vector for cloning into higher organisms
- a. Retrovirus
 - b. Baculovirus
 - c. *Salmonella typhimurium*
 - d. *Rhizopus nigricans*
20. Which bacterium is used in the production of insulin by genetic engineering?
- a. *Saccharomyces*

- b. *Rhizobium*
- c. *Escherichia*
- d. *Mycobacterium*

Assertion Reason Questions

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

1. Assertion : Recombinant DNA technology has become successful because of the presence of restriction endonucleases in eukaryotic cell.

Reason: Restriction endonucleases cut the DNA molecules to form blunt ends.

2. Assertion: The cut pieces of DNA are linked with plasmid DNA.

Reason: Plasmid DNA fails to act as vectors.

3. Assertion: Restriction enzymes recognize palindromic sequence.

Reason: Palindromic sequences read same in both directions of the two strands.

4. Assertion: Restriction enzymes Hind II and Hpa are produced from two different genera of bacteria.

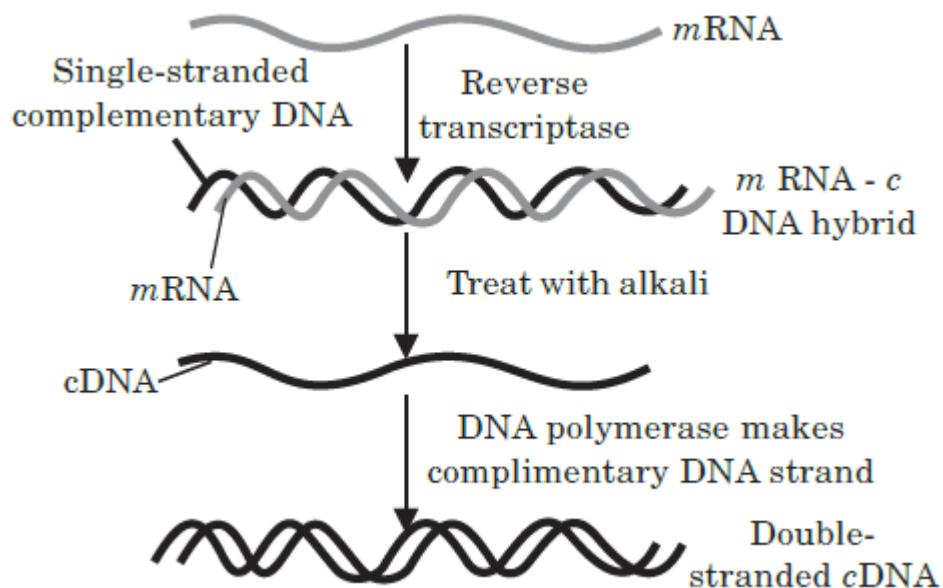
Reason: Hind II is produced from Haemophilus while Hpa is produced from Hematococcus.

5. Assertion : Restriction enzymes of different organisms that recognize the identical sequences are called isoschizomers.

Reason : They are present only in eukaryotes.

CASE STUDY

The DNA, which is transferred from one organism into another by joining it with the vehicle DNA is called passenger or foreign DNA. Generally three types of passenger DNAs are used. These are complementary DNA (cDNA), synthetic DNA (sDNA) and random DNA. Complementary DNA (cDNA) is synthesized on RNA template (usually mRNA) with the help of reverse transcriptase. Synthetic DNA (sDNA) is synthesized on DNA template or without a template. Random DNA are small fragments formed by breaking a chromosome of an organism in the presence of restriction endonucleases.



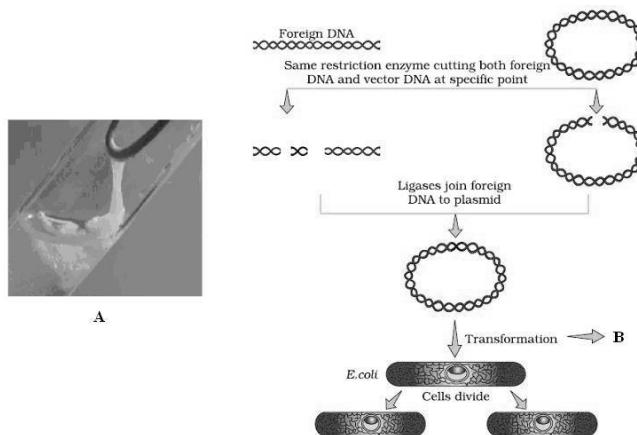
- (i) Who discovered Reverse transcriptase enzyme?
- (ii) During cDNA formation, what would happen if DNA formed by reverse transcriptase is not treated with the alkali?
- (iii) Name the Enzyme that helps in the formation of double stranded cDNA.
- (iv) What is the source of DNA polymerase here?
- (v) DNA synthesised without a template is referred to as what?

2 MARKS QUESTIONS

1. What is elution? How is it performed?
2. Anthropocentric approach to biological phenomenon was aimed at the development of two major needs. Name them.
3. If an alien piece of DNA is inserted in a host cell which two faces would it encounter and why?
4. Name the enzymes in cellular machinery responsible for acting as-
 - a) Scissors
 - b) Glue

5. EcoRI is a restriction enzyme. Elaborate on the convention used for naming it.
6. How are the following used in separation of DNA fragments-?
 - a) Agarose
 - b) Ethyldium bromide
7. Write the use of following in rDNA technology.

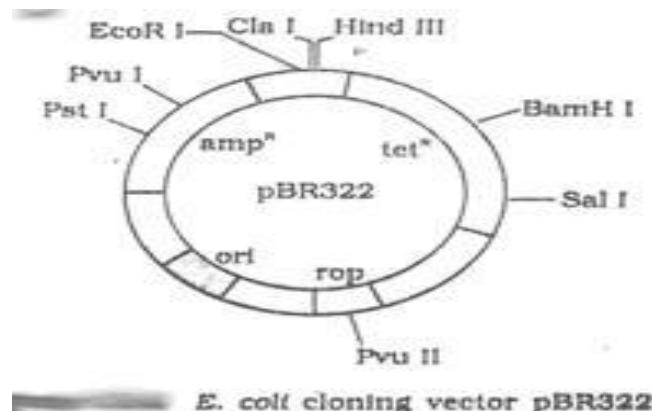
(a) Ethidium bromide	(b) Lac z gene
(c) Chilled ethanol	(d) <i>Agrobacterium tumefaciens</i>
8. Identify the given procedures in rDNA technology.



9. If you were constructing a rDNA which of the given vector would you prefer and why ?
 - a) a vector which has the least cloning sites for a typical restriction enzyme
 - b) a vector which has the most cloning sites for a typical restriction enzyme
10. Complete the steps for separation and isolation of DNA fragments.
 - a. DNA fragment separates in matrix of.....
 - b. DNA fragments are stained with.....
 - c. DNA fragments are stained under.....
 - d. Fragments are extruded from gel piece. This is called.....
11. What are restriction enzymes? Name one restriction enzyme and one enzyme used for joining alien DNA and vector DNA
12. What is the disadvantage of traditional hybridization? How can we overcome this disadvantage?
13. Name the key tools used in genetic engineering.
14. To which class of enzymes, restriction enzymes belong? Name two kinds of restriction enzymes. state their functions
15. What are the palindromic nucleotide sequence in the DNA?
16. Name the cloning vectors. Why do we use them in cloning?
17. A very important gene from a fungal cell has to be extracted. What would you do to break open the cell?

3 MARK QUESTIONS

1. Diagrammatically depict Recombinant DNA technology.
2. Distinguish between Exonuclease and Endonuclease.
3. Since DNA is a hydrophilic molecule, 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.
4. How will you obtain purified DNA from a cell?
5. 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.
6. Why is “Agrobacterium-mediated genetic engineering transformation” in plants considered as natural genetic engineering?
7. a. What does the organization GEAC checks with reference to genetic engineering
b. What does Eco.RI stands for.
c. What is role of molecular scissors in recombinant dna technology?
8. Who has constructed the first DNA recombinant? How did they accomplish this?
9. Explain insertional inactivation with the help of an example
10. Give the steps used in the procedure of recombinant DNA technology
11. In certain cases, ampicillin resistance gene is called as a selectable marker. Why?
12. Study the following figure and answer the questions



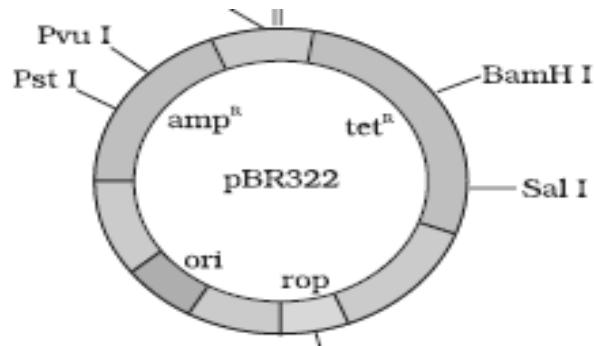
- (a) What does Eco RI & rop in the figure represent?
 - (b) What will happen if transformants with foreign DNA insert at Bam HI (in the above fig) grown on tetracycline containing medium?
 - (c) What is the advantage to use genes coding for α -galactosidase as selectable marker?
13. Explain insertional inactivation with a suitable example
 - Draw a well labelled diagram of fermentor
 - Write function of any two part

5 MARK QUESTIONS

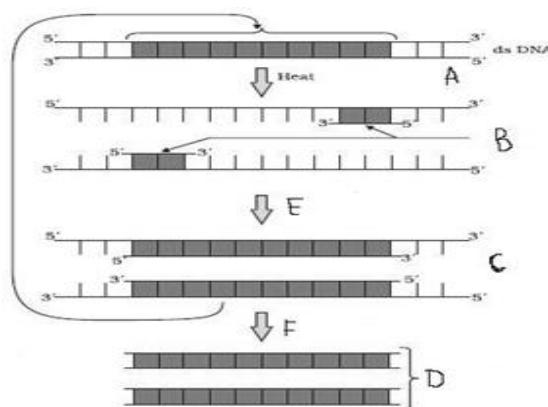
1. Explain the following biotechnological procedures and terms-

- a) Gel electrophoresis
- b) Insertional inactivation
- c) Ti plasmid
- d) Restriction enzymes
- e) Microinjection

2. Observe the following diagram-



- a) What is pBR322?
 - b) What is BamH I site responsible for?
 - c) How is this property used for selection of non recombinants?
 - d) What does rop code for?
 - e) Label any two restriction sites in the diagram which are not labelled?
3. Observe the following diagram-
- a) Which process is depicted in it?
 - b) Identify the process A and why heat is involved in it.
 - c) Which process is depicted by B? Explain it.
 - d) Which process is depicted by C? Explain it.
 - e) During the process E which enzymes are needed?
 - f) F shows a numerical figure, identify it. How does it result in D happening?



- g) How is genetic engineering better than conventional hybridization?

- h) Give one example of each way how genetic modification has made plants more useful?
i) Mention two ethical issues of using genetically modified crops.
4. Name the following
- A. 5'-GAATTC-3' -----
3'-CTTAAG-5'
B. 5'-G AATTC-3'
3'-CTTAA G-5' -----
5. Name the enzyme involved in the following
Breaking the cell to release DNA and macromolecules in plantsrepeated DNA amplifications.....
6. Explain the methods used to separate and isolate DNA fragments.
7. 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?
8. Explain the different methods used for the transferring alien DNA into host cells.
9. What does PCR stand for? Explain PCR with the help of diagram.
10. What are bioreactors? What is the use of this? What are the different types of bioreactors? Explain any one type.
11. How is Bt. Cotton plant produced? Explain mechanism by which plant is able to resist the infestation by cotton bollworm.

SYNOPSIS

CHAPTER -12

BIOTECHNOLOGY AND ITS APPLICATIONS

- The applications of biotechnology include therapeutics, diagnostics and genetically modified crops for agriculture, processed food, bioremediation, waste treatment, and energy production.
- Biotechnology has given to humans several useful products by using microbes, plant, animals and their metabolic machinery.

- Recombinant DNA technology has made it possible to engineer microbes, plants and animals such that they have novel capabilities.

Three critical research areas of biotechnology are:

- (i) Providing the best catalyst in the form of improved organism usually a microbe or pure enzyme.
- (ii) Creating optimal conditions through engineering for a catalyst to act, and
- (iii) Downstream processing technologies to purify the protein/organic compound.

Biotechnological Applications in Agriculture:

- GM plants have been useful in increasing crop yields, reduce postharvest losses and make crops more tolerant of stresses.
- There are several GM crop plants with improved nutritional value of foods and reduced the reliance on chemical pesticides (pest-resistant crops).
Eg, Bt cotton
- The concept of RNA interference is used to develop pest resistance.

Biotechnological Applications in medicine:

- Recombinant DNA technological processes have made immense impact in the area of healthcare by enabling mass production of safe and more effective therapeutics.
- Since the recombinant therapeutics are identical to human proteins, they do not induce unwanted immunological responses and are free from risk of infection as was observed in case of similar products isolated from non-human sources.
- Human insulin is made in bacteria yet its structure is absolutely identical to that of the natural molecule.
- Gene therapy is the insertion of genes into an individual's cells and tissues to treat diseases especially hereditary diseases.
- It does so by replacing a defective mutant allele with a functional one or gene targeting which involves gene amplification.
- Viruses that attack their hosts and introduce their genetic material into the host cell as part of their replication cycle are used as vectors to transfer healthy genes or more recently portions of genes.

Transgenic Animals:

- Transgenic animals are also used to understand how genes contribute to the development of a disease by serving as models for human diseases, such as cancer, cystic fibrosis, rheumatoid arthritis and Alzheimer's.

They also help in researching the following fields-

- (i) Normal physiology and development
- (ii) Study of disease.
- (iii) Biological products

- (iv) Vaccine safety
- (v) Chemical safety testing

Ethical Issues

- The current interest in the manipulation of microbes, plants, and animals has raised several ethical questions.
- Therefore, the Indian Government has set up organizations such as GEAC (Genetic Engineering Approval Committee), which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.
- **Biopiracy** is the term used to refer to the use of bio-resources by multinational companies and other organizations without proper authorization from the countries and people concerned without compensatory payment.

BIOTECHNOLOGY AND ITS APPLICATIONS

1 MARK QUESTIONS-MCQ's

1. Bt cotton is not:
 - a. A GM plant

- b. Insect resistant
 - c. A bacterial gene expressing system
 - d. Resistant to all pesticides
2. C-peptide of human insulin is:
- a. A part of mature insulin molecule
 - b. Responsible for formation of disulphide bridges
 - c. Removed during maturation of pro-insulin to insulin
 - d. Responsible for its biological activity.
3. GEAC stands for:
- a. Genome Engineering Action Committee
 - b. Ground Environment Action Committee
 - c. Genetic Engineering Approval Committee
 - d. Genetic and Environment Approval committee
4. α -1 antitrypsin is:
- a. An antacid
 - b. An enzyme
 - c. Used to treat arthritis
 - d. Used to treat emphysema
5. A probe which is a molecule used to locate specific sequences in a mixture of DNA or RNA molecules could be:
- a. A single stranded RNA
 - b. A single stranded DNA
 - c. Either RNA or DNA
 - d. Can be ss DNA but not ss RNA
6. Choose the correct option regarding Retrovirus:
- a. An RNA virus that can synthesise DNA during infection
 - b. A DNA virus that can synthesise RNA during infection
 - c. A ssDNA virus

- d. A dsRNA virus
7. The site of production of ADA in the body is:
- a. Bone marrow
 - b. Lymphocytes
 - c. Blood plasma
 - d. Monocytes
8. A protoxin is:
- a. A primitive toxin
 - b. A denatured toxin
 - c. Toxin produced by protozoa
 - d. Inactive toxin
9. Pathophysiology is the:
- a. Study of physiology of pathogen
 - b. Study of normal physiology of host
 - c. Study of altered physiology of host
 - d. None of the above
10. The trigger for activation of toxin of *Bacillus thuringiensis* is:
- a. Acidic pH of stomach
 - b. High temperature
 - c. Alkaline pH of gut
 - d. Mechanical action in the insect gut
11. Golden rice is:
- a. A variety of rice grown along the yellow river in China
 - b. Long stored rice having yellow colour tint
 - c. A transgenic rice having gene for – carotene
 - d. Wild variety of rice with yellow coloured grains
12. In RNAi, genes are silenced using:
- a. ss DNA
 - b. ds DNA
 - c. ds RNA
 - d. ss RNA

13. The first clinical gene therapy was done for the treatment of:
- AIDS
 - Cancer
 - Cystic fibrosis
 - SCID (Severe Combined Immuno Deficiency resulting from deficiency of ADA)
14. ADA is an enzyme which is deficient in a genetic disorder SCID. What is the full form of ADA?
- Adenosine deoxy aminase
 - Adenosine deaminase
 - Aspartate deaminase
 - Arginine deaminase
15. Silencing of a gene could be achieved through the use of:
- short interfering RNA (RNAi)
 - antisense RNA
 - by both
 - none of the above

Assertion Reason Questions

- A . If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
- B. If both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
- C. If Assertion is true but the Reason is false.
- D. If both Assertion and Reason are false
1. 1.Assertion : Insulin produced by recombinant DNA technology is more effective than the insulin produced by conventional method .
- Reason : Insulin produced by recombinant DNA technology is more effectively absorbed in blood than the insulin produced by conventional method .
2. Assertion : Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child or embryo.
- Reason : In gene therapy genes are inserted into a person's cells and tissue to treat a disease.
3. Assertion: 'Cry' proteins are named so because they are crystal proteins.
- Reason: In acidic environment of insect midgut 'Cry' proteins are solubilized and then release toxic core fragments after proteolytic action.
4. Assertion: Cry gene expressing crop is resistant to a group of insects.
- Reason: Cry proteins produced from *Bacillus thuringiensis* are toxic to larvae of certain insects.
5. Assertion : Transgenic plant is a product of plant tissue culture.
- Reason : An organism that contains and expresses a transgenic organism.

CASE STUDY

Transgenic cows have extra gene or genes inserted into their DNA. Firstly the genes for the desired product is identified and sequenced. Then a gene construct containing this desired gene is introduced into female cow cells. Transgenic bovine cells are selected and fused with bovine oocytes that have had all of their chromosomes removed. Once fused with the oocyte, the transgenic cells chromosomes are reprogrammed to direct development which can be implanted into a recipient cow. The resulting transgenic cow only express the transgene in her milk. This is because expression of the transgene is controlled by a promoter specific to lactating mammary cells.

- (i) Name the process by which the gene construct with desired gene is introduced into female cow cells.
- (ii) What is the objective of Production of transgenic cow?
- (iii) What is the name of first transgenic cow?
- (iv) How is Transgenic cow produced?

2 MARKS QUESTIONS

- 1.The inactive protoxin Bt becomes active in insect gut. How?
- 2.What is turmeric neem?
- 3.What are cry genes? List the various kinds of cry gene and their use.
- 4.With an example, explain how biotechnology has been applied in each of the following-
 - a. In curing diabetes mellitus?
 - b. In producing more nutritionally balanced milk?
- 5.How has agrobacterium tumefaciens' been suitably modified to act as cloning vector?
- 6.What are transgenic bacteria? Illustrate using any one example.
- 7.Give the 3 critical research area of biotechnology
- 8.Why do we prefer the insulin isolated from other animals?
- 9.Name the techniques that help in the early diagnosis of a disease.
- 10.a) What are the ethical issues raised by the genetic modification of organisms?
b) The Indian Government has recently amended the Indian Patent Bill. Why such amendments were necessary? Justify with an example.

3 MARKS QUESTIONS

- 1.Basmati is a well-known Indian variety of rice but an American company patented it. This was unjust. Give some arguments to prove this.
- 2.What are the three critical areas of research in biotechnology?
- 3.What is a biopatent?

- 4.A biopatent can be granted to an inventor under which areas? (Mention any four).
- 5.Why indigenous people are not in favour of some biopatents. Justify with a suitable example
- 6.What is Bt cotton? How is it developed by genetic modification?
- 7.Diagrammatically represent the experimental steps in cloning and expressing human insulin gene in E. coli.

5 MARKS QUESTIONS

- 1.Give the importance of-
 - a) Rosie the transgenic cow
 - b) ELISA
 - c) ADA
 - d). Insulin
 - e). Agrobacterium vectors
- 2.What do you mean by RNAi? Explain the process. Give its role in biotechnology.
3. i) Define gene therapy. Give its applications
ii)Name the disease which can be cured by gene therapy. Explain the procedure used in this therapy.
- 4.How are agrobacterium tumefaciens used in developing pest resistant plants.?
- 5.How does pro-insulin gets processed to mature insulin?
 - i)Why E. coli could not be used to make insulin?
 - ii)How did Eli lilly meet the challenge for production of active rDNA insulin from E.coli ?

SYNOPSIS
CHAPTER -13
ORGANISMS AND POPULATIONS

- Ecology is a subject which studies the interactions among organisms and between the organism and its physical (abiotic) environment.
- Ecology is basically concerned with four levels of biological organisation – organisms, populations, communities and biomes.

MAJOR ABIOTIC FACTORS

The most important physical factors of the environment to which the organisms are adapted in various ways-

- Temperature
- Light
- Water
- Soil

RESPONSE TO ABIOTIC FACTORS

- Maintenance of a constant internal environment (homeostasis) by the organisms contributes to optimal performance, but only some organisms (regulators) are capable of homeostasis in the face of changing external environment.
- Others either partially regulate their internal environment or simply conform. A few other species have evolved adaptations to avoid

Unfavourable conditions

- In space (migration)
- In time (aestivation)
- Hibernation
- Diapause

ADAPTATIONS

Adaptations is any attribute of the organism (morphological, physiological, Behavioural) that enables the organism to survive and reproduce in its habitat.

POPULATION ATTRIBUTES

- Evolutionary changes through natural selection take place at the population level and hence, population ecology is an important area of ecology.
- A population is a group of individuals of a given species sharing or competing for similar resources in a defined geographical area.

Populations have attributes that individual organisms do not:

- Birth rates
- Death rates
- Sex ratio
- Age distribution

AGE PYRAMID

The proportion of different age groups of males and females in a population is often presented graphically as age pyramid; its shape indicates whether a population is stationary, growing or declining.

GROWTH MODELS

- Ecological effects of any factors on a population are generally reflected in its size (population density), which may be expressed in different ways (numbers, biomass, per cent cover, etc.,) depending on the species.
- Populations grow through births and immigration and decline through deaths and emigration.
- When resources are unlimited, the growth is usually exponential but when resources become progressively limiting, the growth pattern turns logistic. In either case, growth is ultimately limited by the carrying capacity of the environment.
- The intrinsic rate of natural increase (r) is a measure of the inherent potential of a population to grow.

POPULATION ATTRIBUTES

In nature populations of different species in a habitat do not live in isolation but interact in many ways. Depending on the outcome, these interactions between two species are classified as:

- a) Competition-both species suffer
 - b) Predation
 - c) Parasitism-one benefits and the other suffers
 - d) Commensalism-one benefits and the other is unaffected
 - e) Amensalism-one is harmed, other unaffected
 - f) Mutualism-both species benefit
-
- Predation is a very important process through which trophic energy transfer is facilitated and some predators help in controlling their prey populations.
 - Plants have evolved diverse morphological and chemical defences against herbivore.
 - In competition, it is presumed that the superior competitor eliminates the inferior one (the Competitive Exclusion Principle), but many closely related species have evolved various mechanisms which facilitate their co-existence.
 - Some of the most fascinating cases of mutualism in nature are seen in plant-pollinator interactions

CHAPTER 13

ORGANISMS AND POPULATIONS

1 MARK QUESTIONS-MCQ's

1. Autecology is the:
 - a. Relation of a population to its environment
 - b. Relation of an individual to its environment
 - c. Relation of a community to its environment
 - d. Relation of a biome to its environment
2. Ecotone is:
 - a. A polluted area
 - b. The bottom of a lake
 - c. A zone of transition between two communities
 - d. A zone of developing community
3. Biosphere is:
 - a. a component in the ecosystem
 - b. composed of the plants present in the soil
 - c. life in the outer space
 - d. composed of all living organisms present on earth which interact with the physical environment
4. Ecological niche is:
 - a. the surface area of the ocean
 - b. an ecologically adapted zone
 - c. the physical position and functional role of a species within the community
 - d. formed of all plants and animals living at the bottom of a lake
5. According to Allen's Rule, the mammals from colder climates have:
 - a. shorter ears and longer limbs
 - b. longer ears and shorter limbs
 - c. longer ears and longer limbs
 - d. shorter ears and shorter limbs

6. Salt concentration (Salinity) of the sea measured in parts per thousand is:
- 10 – 15
 - 30 – 70
 - 0 – 5
 - 30 – 35
7. Formation of tropical forests needs mean annual temperature and mean annual precipitation as:
- 18 – 25°C and 150 – 400 cm
 - 5 – 15°C and 50 – 100 cm
 - 30 – 50°C and 100 – 150 cm
 - 5 – 15°C and 100 – 200 cm
8. Which of the following forest plants controls the light conditions at the ground?
- Lianas and climbers
 - Shrubs
 - Tall trees
 - Herbs
9. What will happen to a well growing herbaceous plant in the forest if it is transplanted outside the forest in a park?
- It will grow normally
 - It will grow well because it is planted in the same locality
 - It may not survive because of change in its microclimate
 - It grows very well because the plant gets more sunlight
10. If a population of 50 Paramecium present in a pool increases to 150 after an hour, what would be the growth rate of population?
- 50 per hour
 - 200 per hour
 - 5 per hour
 - 100 per hour
11. What would be the per cent growth or birth rate per individual per hour for the same population mentioned in the previous question (Question 10)?
- 100
 - 200
 - 50
 - 150

12. A population has more young individuals compared to the older individuals. What would be the status of the population after some years?
- It will decline
 - It will stabilise
 - It will increase
 - It will first decline and then stabilize
13. What parameters are used for tiger census in our country's national parks and sanctuaries?
- Pug marks only
 - Pug marks and faecal pellets
 - Faecal pellets only
 - Actual head counts
14. Which of the following would necessarily decrease the density of a population in a given habitat?
- Natality > mortality
 - Immigration > emigration
 - Mortality and emigration
 - Natality and immigration
15. Ammensalism is an association between two species where:
- one species is harmed and other is benefitted
 - one species is harmed and other is unaffected
 - one species is benefitted and other is unaffected
 - both the species are harmed.

ASSERTION AND REASON

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

- If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- If Assertion is true but Reason is false.
- If both Assertion and Reason are false.

1. Assertion : Tropical rain forests are disappearing fast from developing countries such as India.

Reason : No value is attached to these forests because these are poor in biodiversity.

2. Assertion : Flora contains the actual account of habitat and distribution of plants of a given area.

Reason : Flora helps in correct identification.

3. Assertion : Species are groups of potentially interbreeding natural populations which are isolated from other such groups.

Reason : Distinctive morphological characters are displayed due to reproductive isolation.

4. Assertion: “The Biological Species” concept helps us to ask how species are formed.

Reason: The concept of biological species focuses our attention on the question of how reproductive isolation comes about.

5. Assertion : Cold deserts too exist. e.g., Tibet, Gobi.

Reason : Desert can be hot, e.g., Thar, Sahara.

CASE STUDY

Organism P has thick lips and tongue so that it can easily feed on the commonly available spiny plants. Organism Q has thick layer of insulating fat under the skin. It was strong hooves to walk steadily on steep surfaces and lives in burrows during winters. Organism R has bright colours and sticky pads on its fingers and toes. It lives on trees.

(i) Name the correct habitat for organisms P regarding its adaptation?

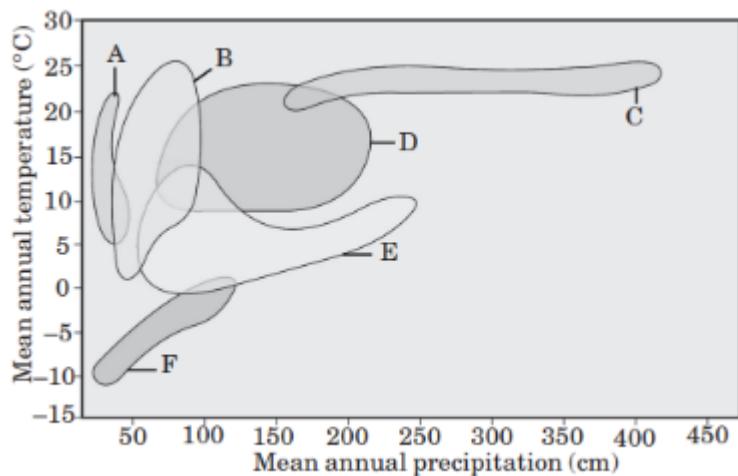
(ii) Which of the following is correct match regarding organism Q and its habitat?

- (a) Tundra – Polar bear
- (b) Tropical rain forest – Deer
- (c) Grassland – Bighorn sheep
- (d) Desert – Camel

(iii) Make a note of organism R’s habitat?

(iv) Write example for dominant plants in habitat where P lives.

(v) Organisms P, Q and R respectively most likely occur in which of the following from A_F.



2 MARK QUESTIONS

1. How do human beings maintain a body temperature of 37 degree centigrade?
- a) What kind of animals are the seasonal breeders?
- b) What is the habitat of such animals?
2. What happens when in an ecosystem the predator is very efficient?
3. Differentiate between stenohaline and euryhaline organisms.
4. List four features which enable the Xeric plants to survive in the desert conditions.
5. Mention the attributes which a population has but not an individual organism.
6. Explain the term brood parasitism using an example.
7. Explain the term competitive release using an example.
8. What is Darwinian fitness? How does it affect the reproductive strategy of an organism?
9. Write the equation depicting VP growth curve.
10. What does asymptote designate in it?
11. Which attribute of human population do the following figures represent?
12. What is the important role played by predators?
13. Name the following organisms i) Breed only once in their life time ii) Breed many times iii) Produce large sized animals iv) Produce small sized animals
14. State Gause's Competitive Exclusion Principle.
15. Give the differences between ectoparasite and endoparasites by giving examples.

3 MARK QUESTIONS

1. How do the following organisms adapt to xerophytic adaptations-
 - a) Kangaroo rat
 - b) Opuntia

c) Camel

2. Observe the following graph and answer-

- a) Which group of organisms is shown by A and B?
- b) How does being in Group A contribute to ecological success of its members?
- c) Name the two alternative methods that members of Group B resort to deal with stressful conditions?

3. Draw a graph for a population whose population density has reached the carrying capacity.

4. Name the interactions seen in-

- a) Cuscuta growing on shoe flower plant
- b) Mycorrhiza living in roots of higher plants
- c) Clown fish living amongst tentacles of sea anemone
- d) Koel laying its eggs in crow's nest
- e) Sucker fish attached to shark
- f) Wasp pollinating fig inflorescence

5. What is an age pyramid? What do they show for human population? Represent diagrammatically the different shapes of age pyramids and what shapes each of them represents?

6. Explain with examples, how do the plant animal interactions involve co-evolution.

7. How does the shape of age pyramid reflect the growth status of a population?

8. 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?

9. 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

10. Give one example of the following interactions:

- a) Egrets foraging close to the calves.
- b) Lichens
- c) Abingdon tortoise and goats

5 MARK QUESTIONS

1. Define natality, mortality, immigration and emigration. Using a diagram and equation show how these processes affect population density.

2. Represent stable, expanding and declining populations as age pyramids.

3. Orchid flower, Ophrys co-evolves to maintain resemblance of its petal to female bee. Explain how and why does it do so?

4. What is altitude sickness? What are its causes and symptoms? How does human body try to overcome altitude sickness?

5. How do population attributes affect these age pyramids?

6. Explain the following ecological phenomenon-

- a) Animals do not forage on Calotropis
- b) Resource partitioning
- c) Abingdon tortoise became extinct on Galapagos island
- d) Mycorrhizae
- e) Mentalism

7. Describe the exponential growth model of a diagram along with a curve.

8. Give the adaptations seen in the following organisms:

i) Desert plants ii) Mammals from cold climates iii) Archaeabacteria iv) Antarctic fishes v) Desert lizards

9. Why are the predators in nature prudent? Give the defense mechanism seen in the following organisms

i) Certain types of insects and frogs ii) Monarch butterfly iii) Plants like Acacia, Calotropis.

SYNOPSIS
CHAPTER -14
ECOSYSTEM

- An ecosystem is a functional unit of nature and comprises
 - a. Abiotic components
 - b. Biotic components
- Abiotic components are inorganic materials- air, water and soil.
- Biotic components are producers, consumers and decomposers.
- Each ecosystem has characteristic physical structure resulting from interaction amongst abiotic and biotic components.
- Species composition and stratification are the two main structural features of an ecosystem. Based on source of nutrition every organism occupies a place in an ecosystem.
- Four important components of an ecosystem
 - a. Productivity
 - b. Decomposition
 - c. Energy flow
 - d. Nutrient cycling
- Primary productivity is the rate of capture of solar energy or biomass production of the producers. It is divided into two types:
 - a. Gross primary productivity (GPP)
 - b. Net primary productivity (NPP)
- Rate of capture of solar energy or total production of organic matter is called as GPP.
- NPP is the remaining biomass or the energy left after utilisation of producers.
- Secondary productivity is the rate of assimilation of food energy by the consumers.
- In decomposition, complex organic compounds of detritus are converted
 - to carbon dioxide, water and inorganic nutrients by the decomposers.

Decomposition involves three processes

- a. Fragmentation of detritus
 - b. Leaching
 - c. Catabolism
-
- Energy flow is unidirectional.
 - First, plants capture solar energy and then, food is transferred from the producers to decomposers.

- Organisms of different trophic levels in nature are connected to each other for food or energy relationship forming a food chain.

Nutrient cycling

- The storage and movement of nutrient elements through the various components of the ecosystem is called nutrient cycling nutrients are repeatedly used through this process.
- Nutrient cycling is of two types
 - a. Gaseous
 - b. Sedimentary
- Atmosphere or hydrosphere is the reservoir for the gaseous type of cycle (carbon), whereas Earth's crust is the reservoir for sedimentary type (phosphorus).

Ecosystem services

- Products of ecosystem processes are named as ecosystem services, e.g., purification of air and water by forests.
- Researchers have put an average price tag of US \$ 33 trillion a year on these fundamental ecosystem's services, which are largely taken for granted because they are free. This is nearly twice the value of the global gross national product GNP which is (US \$ 18 trillion).

Ecological succession

- The biotic community is dynamic and undergoes changes with the passage of time.
- These changes are sequentially ordered and constitute ecological succession
- Succession begins with invasion of a bare lifeless area by pioneers which later pave way for successors and ultimately a stable climax community is formed.
- The climax community remains stable as long as the environment remains unchanged.

CHAPTER 14- ECOSYSTEM

1 MARK QUESTIONS-MCQ's

1. Decomposers like fungi and bacteria are:
 - i. autotrophs
 - ii. heterotrophs
 - iii. saprotrophs
 - iv. chemoautotrophs.Choose the correct answer:
 - (a) i and iii,
 - (b) i and iv
 - (c) ii and iii,
 - (d) i and ii
2. The process of mineralization by microorganisms helps in the release of:
 - a. inorganic nutrients from humus
 - b. both organic and inorganic nutrients from detritus
 - c. organic nutrients from humus
 - d. inorganic nutrients from detritus and formation of humus.
3. Productivity is the rate of production of biomass expressed in terms of:
 - i. $\text{kcal m}^{-3} \text{ yr}^{-1}$
 - ii. $\text{g}^{-2} \text{ yr}^{-1}$
 - iii. $\text{g}^{-1} \text{ yr}^{-1}$
 - iv. $(\text{kcal m}^{-2}) \text{ yr}^{-1}$
 - (a) ii,
 - (b) iii,
 - (c) ii and iv,
 - (d) i and iii
4. An inverted pyramid of biomass can be found in which ecosystem?
 - a. Forest
 - b. Marine
 - c. Grass land
 - d. Tundra
5. Which of the following is not a producer?
 - a. Spirogyra
 - b. Agaricus

- c. Volvox
 - d. Nostoc
6. Which of the following ecosystems is most productive in terms of net primary production?
- a. Deserts
 - b. Tropical rain forests
 - c. Oceans
 - d. Estuaries
7. Pyramid of numbers is:
- a. Always upright
 - b. Always inverted
 - c. Either upright or inverted
 - d. Neither upright nor inverted.
8. Approximately how much of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis?
- a. Less than 1%
 - b. 2-10%
 - c. 30%
 - d. 50%
9. Among the following, where do you think the process of decomposition would be the fastest?
- a. Tropical rain forest
 - b. Antarctic
 - c. Dry arid region
 - d. Alpine region
10. How much of the net primary productivity of a terrestrial ecosystem is eaten and digested by herbivores?
- a. 1%
 - b. 10%
 - c. 40%
 - d. 90%
11. During the process of ecological succession the changes that take place in communities are:
- a. Orderly and sequential
 - b. Random
 - c. Very quick
 - d. Not influenced by the physical environment.

12. Climax community is in a state of:
- non-equilibrium
 - equilibrium
 - disorder
 - constant change.
13. Among the following bio-geo-chemical cycles which one does not have losses due to respiration?
- Phosphorus
 - Nitrogen
 - Sulphur
 - All of the above
14. The sequence of communities of primary succession in water is:
- phytoplankton, sedges, free-floating hydrophytes, rooted hydrophytes, grasses and trees.
 - phytoplankton, free-floating hydrophytes, rooted hydrophytes, sedges, grasses and trees.
 - free-floating hydrophytes, sedges, phytoplankton, rooted hydrophytes, grasses and trees.
 - phytoplankton rooted submerged hydrophytes, floating hydrophytes, reed swamp, sedges, meadow and trees.
15. The reservoir for the gaseous type of bio-geo chemical cycle exists in
- stratosphere
 - atmosphere
 - ionosphere
 - lithosphere

ASSERTION REASON

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

- If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
- If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
- If Assertion is true but Reason is false.
- If both Assertion and Reason are false.

1. Assertion (A): Ecosystem is an open system.

Reason (R): Ecosystem receives input in the form of solar energy alone from the surroundings.

2. Assertion [A] - The earth is a closed system with respect to matter and open with respect to energy.

Reason [R] - Energy is not recycled in an ecosystem

3. Assertion [A] : Food chains start with photosynthesis and end with decomposition.

Reason [R]: In an ecosystem, plants produce food and decomposers help in decay of dead matter.

4. Assertion [A]: Decomposers may be excluded from the food chains.

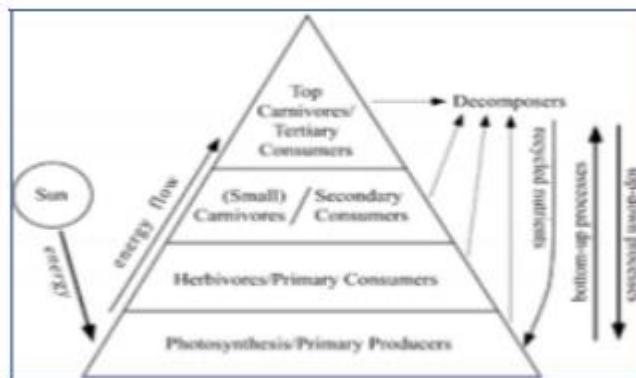
Reason [R]: They act at all trophic levels of food chains.

5. Assertion : Energy can neither be created nor be destroyed.

Reason : Only 10% of energy from an organism is transferred to the next trophic level while the remaining is lost.

CASE STUDY

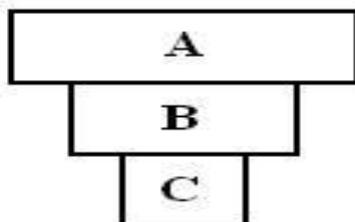
Organisms in an ecosystem acquire energy in a variety of ways, which is transferred between trophic levels as the energy flows from the bottom to the top of the food web, with energy being lost at each transfer. The efficiency of these transfers is important for understanding the different behaviours and eating habits of warmblooded versus cold-blooded animals. Modelling of ecosystem energy is best done with ecological pyramids of energy, although other ecological pyramids provide other vital information about ecosystem structure.



- i. Pyramid of energy is always upright'. Substantiate this statement.
- ii. The essence of second law of thermodynamics is 'no form of energy can fully convert into another form of energy'. Analyse this statement with reference to energy flow.
- iii. Construct a pyramid of energy in aquatic ecosystem consisting of 4 members.
(Net primary productivity is 10000 J)

2 MARK QUESTIONS

1. Diagrammatically represent an ideal pyramid of energy in a grassland ecosystem.
2. What is a climax community? Give example.
3. Differentiate between Gross Primary Productivity and Net Primary Productivity.
4. What is annual net productivity of the whole biosphere? What is the contribution of marine bodies in it?
5. Differentiate between leaching and catabolism in a detritus food chain.
6. Draw a pyramid of biomass for Sea.
7. Draw pyramid of number for the given food chain. Tree, birds and insects (ectoparasite on birds)
8. Construct a food chain which shows the pyramid of number given below:



9. Pyramids of number, energy and biomass are mostly upright .is there exception to it?
- 10.Explain the functions of ecosystem
- 11.Give the diagrammatic representation of decomposition cycle in a terrestrial ecosystem.

- 12.Explain the flow of energy in an ecosystem.
- 13.Explain DFC with the help of an example.
- 14.Explain each term with the help of examples
 - i) Primary consumers ii) secondary consumers
- 15.Gaseous nutrient cycle and sedimentary nutrient cycles have their reservoir. Name them. Why is a reservoir necessary?

3 MARK QUESTIONS

- 1.Taking the example of a pond ecosystem explain the components of this ecosystem highlighting-
 - a) Productivity
 - b) Decomposition
 - c) Energy flow
 - d) Nutrient cycling
- 2.Give reasons for-
 - a) Low productivity of oceans in comparison to land
 - b) Requirement of oxygen for decomposition
 - c) Less than 50% of incident solar radiation is PAR
- 3.Give two examples for terrestrial ecosystem
 - ii) Aquatic ecosystem iii) Artificial ecosystem
- 4.What do you mean by ecosystem services? Who has put price tags on nature's life and support services. Give the value. What are the services offered by healthy ecosystem?
- 5.Explain the steps in the process of decomposition.
- 6.Find out the consumer of top order/ top carnivore from the following food chains.
 - a) Phytoplankton-> small fishes-> large fishes-> Hawk
 - b) Phytoplankton-> Zooplankton-> Fishes->Man
- 7.What are mycorrhiza? Differentiate between endomycorrhiza and ectomycorrhiza
8. (a) Write two points of differences between primary and secondary community.
(b)Name the pioneer species that invades bare rock. How do they pave way for the next species?

5 MARK QUESTIONS

- 1.Why is Phosphorus a necessary vital constituent of living organisms?
- a) How does Phosphorus cycle take place in terrestrial ecosystems?
- b) Enumerate eight ecosystem services provided to us by the biosphere.
- 2.Ecosystems follow Laws of Thermodynamics. Justify this statement.
- 3.Describe the following ecological terms using examples-
 - a. Secondary succession
 - b. Mesic community
 - c.Biogeochemical Cycle
 - d.Pioneer species
 - e. Ecological Pyramid
- 4.Tabulate the gradual changes taking place in an area where bare rocks were present to formation of forests.
- 5.Carbon cycle in nature is biogeochemical event. explain
- 6.Define productivity. Explain the different types of productivity.

7.Detritivores like earthworm are involved in the process of decomposition of dead plants and animals. Describe the different steps involved in the process of decomposition.

8.i) Define ecological succession.

ii)What are the different types of succession.? Give the differences between them.

iii)On what basis, succession of plants is classified? Name them. Give the differences between them. Give the different stages in hydrarch

iv) Give the differences between xerarch and hydrarch.

9.What do you mean by biogeochemical cycle? Name the two types of nutrient cycle. Give the differences between them.

10.With the help of schematic representation explain phosphorous cycle. Give the differences between carbon and phosphorous cycle

SYNOPSIS **CHAPTER -15**

BIODIVERSITY AND CONSERVATION

BIODIVERSITY

Since life originated on earth nearly 3.8 billion years ago, there had been enormous diversification of life forms on earth.

Biodiversity refers to the sum total of diversity that exists at all levels of biological organisation. These include the diversity at

- Genetic,
- Species
- Ecosystem levels

Conservation efforts are aimed at protecting diversity at all these levels.

BIODIVERSITY ON EARTH AND IN INDIA

- More than 1.5 million species have been recorded in the world, but there might still be nearly 6 million species on earth waiting to be discovered and named. Of the named species, > 70 per cent are animals, of which 70 per cent are insects.
- The group Fungi has more species than all the vertebrate species combined. India, with about 45,000 species of plants and twice as many species of animals, is one of the 12 mega diversity countries of the world.

BIODIVERSITY PATTERNS

- Species diversity on earth is not uniformly distributed but shows interesting patterns.
- It is generally highest in the tropics and decreases towards the poles.
- Important explanations for the species richness of the tropics are:
 - Tropics had more evolutionary time;
 - they provide a relatively constant environment and,
 - they receive more solar energy which contributes to greater productivity.
- Species richness is also function of the area of a region; the species-area relationship is generally a rectangular hyperbolic function

IMPORTANCE OF BIODIVERSITY

- It is believed that communities with high diversity tend to be less variable, more productive and more resistant to biological invasions.

- Earth's fossil history reveals incidence of mass extinctions in the past, but the present rates of extinction, largely attributed to human activities, are 100 to 1000 times higher. Nearly 700 species have become extinct in recent times and more than 15,500 species (of which > 650 are from India currently faces the threat of extinction).
- The causes of high extinction rates at present include habitat (particularly forests) loss and fragmentation, over-exploitation, biological invasions and co-extinctions.
- Earth's rich biodiversity is vital for the very survival of mankind.
- The reasons for conserving biodiversity are narrowly utilitarian, broadly utilitarian and ethical. Besides the direct benefits (food, fibre, firewood, pharmaceuticals, etc.), there are many indirect benefits we receive through ecosystem services such as pollination, pest control, climate moderation and flood control. We also have a moral responsibility to take good care of earth's biodiversity and pass it on in good order to our next generation.

BIODIVERSITY CONSERVATION

- Biodiversity conservation may be *in situ* as well as *ex situ*.
- In *in situ* conservation, the endangered species are protected in their natural habitat so that the entire ecosystem is protected.
- Recently, 34 '**biodiversity hotspots**' in the world have been proposed for intensive conservation efforts. Of these, three (Western Ghats-Sri Lanka, Himalaya and Indo-Burma) cover India's rich biodiversity regions.

Our country's *in situ* conservation efforts are reflected in its 14 biosphere reserves, 90 national parks, > 450 wildlife sanctuaries and many sacred groves.

Ex situ conservation methods include

- protective maintenance of threatened species in zoological parks and botanical gardens
- *in vitro* fertilization
- tissue culture propagation
- Cryopreservation of gametes.

CHAPTER 15
BIODIVERSITY AND CONSERVATION

1 MARK QUESTIONS-MCQ's

1. Which of the following countries has the highest biodiversity?
 - a. Brazil
 - b. South Africa
 - c. Russia
 - d. India
2. Which of the following is not a cause for loss of biodiversity?
 - a. Destruction of habitat
 - b. Invasion by alien species
 - c. Keeping animals in zoological parks
 - d. Over-exploitation of natural resources
3. Which of the following is not an invasive alien species in the Indian context?
 - a. Lantana
 - b. Cynodon
 - c. Parthenium
 - d. Eichhornia
4. Where among the following will you find pitcher plant?
 - a. Rain forest of North-East India
 - b. Sunderbans
 - c. Thar Desert
 - d. Western Ghats
5. Which one of the following is not a major characteristic feature of biodiversity hot spots?
 - a. Large number of species
 - b. Abundance of endemic species
 - c. Large number of exotic species
 - d. Destruction of habitat

6. Match the animals given in column A with their location in column B:

Column A

- (i) Dodo
- (ii) Quagga
- (iii) Thylacine
- (iv) Stellar's sea cow

Column B

- (a) Africa
- (b) Russia
- (c) Mauritius
- (d) Australia

7. Choose the correct match from the following:

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

8. What is common to the following plants: Nepenthes, Psilotum, Rauwolfia and Aconitum?

- a. All are ornamental plants
- b. All are phylogenetic link species
- c. All are prone to over exploitation
- d. All are exclusively present in the Eastern Himalayas.

9. The one-horned rhinoceros is specific to which of the following sanctuary

- a. Bhitarkanika
- b. Bandipur
- c. Kaziranga
- d. Corbett park

10. Amongst the animal groups given below, which one has the highest percentage of endangered species?

- a. Insects
- b. Mammals
- c. Amphibians
- d. Reptiles

11. Which one of the following is an endangered plant species of India?

- a. Rauwolfia serpentina
- b. Santalum album (Sandal wood)
- c. Cycas beddomei
- d. All of the above.

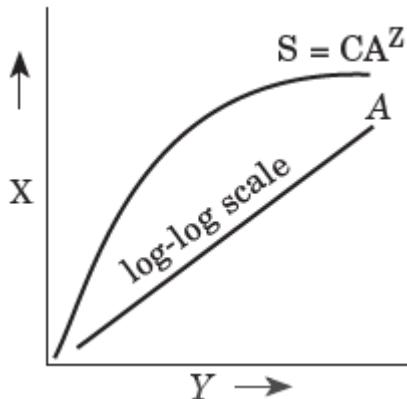
12. What is common to Lantana, Eichhornia and African catfish?
- All are endangered species of India.
 - All are key stone species.
 - All are mammals found in India.
 - All the species are neither threatened nor indigenous species of India.
13. The extinction of passenger pigeon was due to:
- Increased number of predatory birds.
 - Over exploitation by humans.
 - Non-availability of the food.
 - Bird flu virus infection.
14. Which of the following statements is correct?
- Parthenium is an endemic species of our country.
 - African catfish is not a threat to indigenous catfishes.
 - Steller's sea cow is an extinct animal.
 - Lantana is popularly known as carrot grass.
15. Among the ecosystem mentioned below, where can one find maximum biodiversity?
- Mangroves
 - Desert
 - Coral reefs
 - Alpine meadows
- ASSERTION REASON**
1. Assertion : Alpha diversity is said to be higher if the dissimilarity between communities is higher.
Reason :Alpha diversity is a measure of diversity between the communities.
2. Assertion: The species diversity present in a given community or habitat is referred to as alpha diversity.
Reason: Alpha diversity is usually expressed by species richness and species evenness in that community habitat.
3. Assertion : Diversity observed in the entire geographical area, is called gamma diversity.
Reason : Bio-diversity decreases from high altitude to low altitude.
4. Assertion : A biosphere reserve is a specified area.
Reason : No restriction on human activities has been imposed in biosphere reserve.

5. Assertion : In tropical rain forests. O-horizon and A-Horizon of soil profile are shallow and nutrient-poor.

Reason : Excessive growth of micro-organisms in the soil depletes its organic content.

CASE STUDY

Within a region, species richness increases with increasing explored area, but only upto a limit. The given graph explains this relationship.



- (i) What does the given figure show?
- (ii) Write the equation for relationship (A) between species richness and area.
- (iii) What is the value of slope of line or regression coefficient Z for frugivorous birds?
- (iv) What is the shape of curve for relationship between species richness and areas for a wide variety of taxa?
- (v) Who gave this concept of increase in species richness with increasing area?

2 MARK QUESTIONS

1. Why are Western Ghats more bio diverse than Eastern Ghats?
2. If natural pollinators are removed from an ecosystem what could be the possible consequences?
3. Explain Alexander Humboldt theory regarding the species area relationship
4. A survey of latitudinal gradients of biodiversity is as follows:

Columbia near equator		1400 species
India	8° N	1200 species
New York	41° N	105 species
Greenland	71° N	55 Sp.s.

- a) What does it indicate? What are the reasons for such distribution?
 - b) What would be the effect of enhanced global warming on biodiversity according to the given example?
5. Why small animals are rarely found in polar regions?
 6. According to broadly utilitarian arguments why should we conserve biodiversity?
 7. Give examples for the alien species that pose threat to native species?
 8. What do you mean by endemism? Give examples.
 9. What area hot spots.? Give examples.
 10. Give the objectives of - The Earth Summit.
 11. What area sacred groves. Give examples
 12. What do you mean by Red List? What does it documents?
 13. Give examples for recent extinct animals. State the reasons for their extinction.
 14. How the sixth Extinction presently in progress in the different species extinction rates are estimated to nearly 100 to 1000 times faster than in the pre-human times.
 15. What do you mean by Z value related to species -area relationship? Give the Z value in one region and in entire continent.

3 MARK QUESTIONS

1. In what reference following terms are used
 - a. Lungs of planet.
 - b. Sixth extinction
 - c. Evil quartet
2. Discuss the role of women and communities in protection and conservation of forests.
3. Give three reasons for conserving biodiversity. Explain this with the help of examples
4. What is so special about tropics that might account for their greater biological diversity?
5. 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’?
6. What is so special about tropics that might account for their greater biological diversity?
7. 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?

5 MARK QUESTIONS

1. Explain Ex situ and In situ conservation with the help of an example.
2. Explain the causes of biodiversity losses.
3. What are The Evil Quartet? Explain
4. Who has proposed rivet popper hypothesis? How is this hypothesis related to biodiversity?

SYNOPSIS
CHAPTER -16
ENVIRONMENTAL ISSUES

Pollution is any undesirable change in physical, chemical or biological characteristics of air, land, water or soil. Agents that bring about such an undesirable change are called as **pollutants**

AIR POLLUTION AND ITS CONTROL

Harmful effects of air pollution-

- Reduce growth and yield of crops
- Cause premature death of plants
- Deleteriously affect the respiratory system of humans and of animals.
- Irritation,
- Inflammations
- Damage to the lungs
- Premature deaths.

Sources-

- Smokestacks of thermal power plants,
- Smelters
- Other industries
- Automobiles

Removal of particulate matter-

- Electrostatic precipitator
- Scrubber
- Catalytic converters

WATER POLLUTION AND ITS CONTROL

Domestic sewage is the most common source of pollution of water bodies. It mainly has the following bad effects

- Reduces dissolved oxygen
- Increases biochemical oxygen demand of receiving water

Domestic sewage is rich in nutrients, especially, nitrogen and phosphorus, which cause

- Eutrophication
- Nuisance algal blooms
- Industrial waste waters are often rich in toxic chemicals, especially heavy metals and organic compounds.
- Industrial waste waters harm living organisms.
- Municipal solid wastes also create problems and must be disposed of in landfills.
- Disposal of hazardous wastes like defunct ships, radioactive wastes and e-wastes requires additional efforts.

SOLID WASTE

Disposal of hazardous wastes like defunct ships, radioactive wastes and e-wastes requires additional efforts. We have to learn lessons from disasters which took place in Three Mile Island and Chernobyl.

AGRO CHEMICALS AND THEIR EFFECTS

Soil pollution primarily results from agricultural chemicals (e.g., pesticides) and leaches from solid wastes deposited over it. A possible solution could be organic farming which is consumer friendly.

MAJOR ENVIRONMENTAL ISSUES

Two major environmental issues of global nature are increasing

- Greenhouse effect, which is warming Earth
- Depletion of ozone in the stratosphere

Enhanced greenhouse effect is mainly due to increased emission of

- Carbon dioxide
- Methane
- Nitrous oxide
- CFCs
- Deforestation

It may drastically

- Change rainfall pattern
- Increase global temperature
- Detrimentally affect living organisms

Ozone in the stratosphere, which protects us from harmful effects of Ultraviolet radiation, is depleting fast due to emission of CFCs thus

- Increasing the risks of skin cancer
- Mutation
- Other disorders

CHAPTER 16 -ENVIRONMENTAL ISSUES

1 MARK QUESTIONS-MCQ's

1. Non-biodegradable pollutants are created by:
 - a. nature
 - b. excessive use of resources
 - c. humans
 - d. natural disasters
2. According to the Central Pollution Control Board, particles that are responsible for causing great harm to human health are of diameter:
 - a. 2.50 micrometers
 - b. 5.00 micrometers
 - c. 10.00 micrometers
 - d. 7.5 micrometers
3. The material generally used for sound proofing of rooms like a recording studio and auditorium, etc. is:
 - a. cotton
 - b. coir
 - c. wood
 - d. styrofoam
4. Compressed Natural Gas (CNG) is:
 - a. propane
 - b. methane
 - c. ethane
 - d. butane
5. World's most problematic aquatic weed is:
 - a. Azolla
 - b. Wolffia
 - c. Eichornia
 - d. Trapa
6. Which of the following causes biomagnification?
 - a. SO₂
 - b. Mercury
 - c. DDT
 - d. Both b & c
7. The expanded form of DDT is:

- a. dichloro diphenyl trichloroethane
 - b. dichloro diethyl trichloroethane
 - c. dichloro dipyridyl trichloroethane
 - d. dichloro diphenyl tetrachloroacetate
8. Which of the following material takes the longest time for biodegradation?
- a. Cotton
 - b. Paper
 - c. Bone
 - d. Jute
9. Choose the incorrect statement.
- a. The Montreal protocol is associated with the control of emission of ozone depleting substances
 - b. Methane and carbon dioxide are green house gases
 - c. Dobson units are used to measure oxygen content
 - d. Use of incinerators is crucial to disposal of hospital wastes
10. Among the following which one causes more indoor chemical pollution?
- a. burning coal
 - b. burning cooking gas
 - c. burning mosquito coil
 - d. room spray
11. The green scum seen in the fresh water bodies is:
- a. blue green algae
 - b. red algae
 - c. green algae
 - d. both (a) and (c)
12. The major source of noise pollution, worldwide is due to:
- a. office equipment
 - b. transport system
 - c. sugar, textile and paper industries
 - d. oil refineries and thermal power plants.
13. Match correctly the following and choose the correct option
- | | |
|---|---------|
| i. Environment Protection Act | A. 1974 |
| ii. Air Prevention & Control of Pollution Act | B. 1987 |
| iii. Water Act | C. 1986 |

The correct matches is;

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

14. Catalytic converters are fitted into automobiles to reduce emission of harmful gases. Catalytic converters change unburnt hydrocarbons into:

- a. carbon dioxide and water
- b. carbon mono oxide
- c. methane
- d. carbon dioxide and methane

15. Why is it necessary to remove sulphur from petroleum products?

- a. To reduce the emission of sulphur dioxide in exhaust fumes
- b. To increase efficiency of automobiles engines
- c. To use sulphur removed from petroleum for commercial purposes
- d. To increase the life span of engine silencers

ASSERTION REASON

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

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

1. Assertion : Pollution is always caused by human activities.

Reason : Pollution is not different from contamination.

2. Assertion: Through the use of catalytic converters, unburnt hydrocarbons are changed into carbon monoxide which in turn is changed into nitrogen oxides and water.

Reason: Motor vehicles equipped with catalytic converters should use leaded petrol to protect the catalyst from degradation.

3. Assertion : Suspended particulate matter (SPM) is an important pollutant released by diesel vehicles.

Reason : Catalytic converters greatly reduce pollution caused by automobiles.

4. Assertion: Bharat stage IV emission norms have been in place since April 2010, for 4 wheelers in 13 mega cities of India.

Reason: Green muffler scheme refers to the plantation of trees and shrubs along road sides and is effective to control noise pollution only.

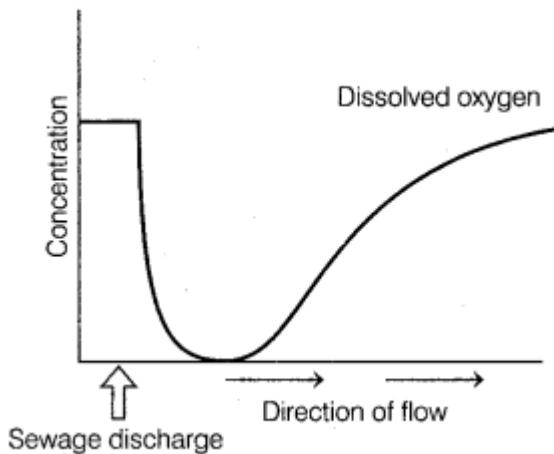
5. Assertion: Compressed natural gas (CNG) is natural gas under pressure and mainly composed of methane.

Reason: One of the advantages of using CNG as a fuel in automobiles is that it requires very less space for storage as compared to that of petrol or diesel.

CASE STUDY

Study the graph given below.

- i. Explain, how is oxygen concentration affected in the river when sewage is discharged into it.

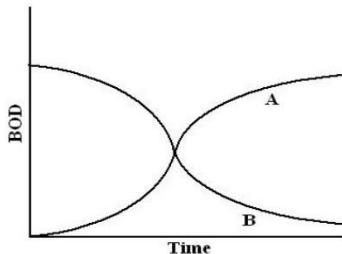


- ii. Explain, how does the algal bloom eventually choke the water body in an industrial area?
- iii. BOD was measured in two different places A and B of a river in the direction of its flow. BOD value was higher at A than at B. What do you infer from this observation and why?

2 MARK QUESTIONS

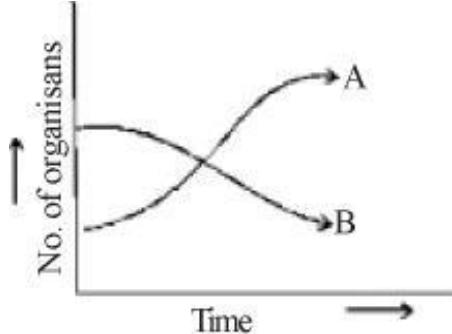
1. Diagrammatically depict a scrubber and state which gases it removes.
2. Why is a scrubber used? Which spray is used on exhaust gases passing through a scrubber
3. Catalytic converters use expensive metals as catalysts.
 - (a) Name the metals generally used.
 - (b) What precaution should be observed while using catalytic converter.
4. Enumerate the possible dangers of a sanitary landfill to the ecosystem.
5. What recommendation is followed for disposal of nuclear waste?
6. Name four heavy metals used in industries which undergo the process of Biological magnification.
7. Electrostatic precipitator can remove over 99% particulate matter present in exhaust from a thermal power plant. How?
8. How does Accelerated Eutrophication take place?
9. What are EcoSan toilets?

10. What are e-wastes? Why are they creating more problem in developing countries in comparison to developed countries?
11. Name any two substances that cause biological magnification.
 - (a) What are Flocs?
 - (b) Which graph represents the BOD of water when floes are used? Why



12. Explain, how integrated organic farming can help to reduce/check eutrophication
 13. a) What was the reason of signing Montreal Protocol treaty? Explain.
b) Why was PIL filed in supreme court of India? Write two steps that Delhi government was asked to implement in Delhi.
 - 14 a) Why CNG is better fuel than diesel?
b) Mention any two parallel steps taken by Delhi Government to reduce vehicular pollution along with use of CNG.
15. The graph below represents the growth patterns of two types of aquatic organisms over a brief period in a water body surrounded by an agricultural land extensively supplied with fertilizers.

- a) 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 to it.

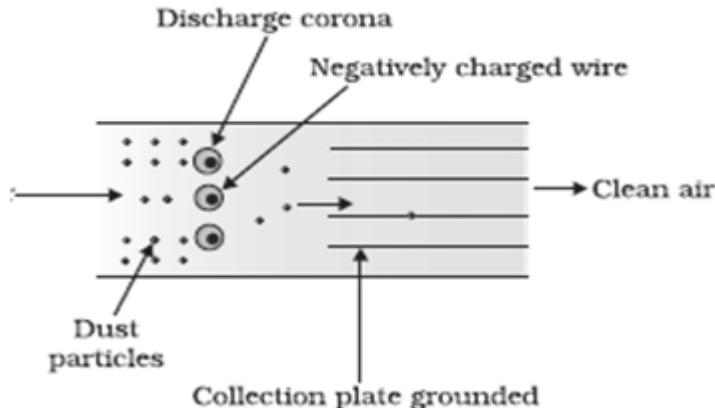
3 MARK QUESTIONS

1. Automobiles are a major source of air pollution. What steps can be taken to minimize this problem?
2. What is biological magnification? How does DDT as a water pollutant undergo biological magnification?
3. Discuss briefly the following:
 - (a) Greenhouse effect
 - (b) Catalytic converter
 - (c) Ultraviolet-B.
 - (d) Differentiate litter from detritus.

- (e) Mention the steps in the process of decomposition leading to degradation of detritus into simpler inorganic substances.
4. Microbes play a dual role when used for sewage treatment as they not only help to retrieve usable water but also generate fuel. Write in points how this happens?

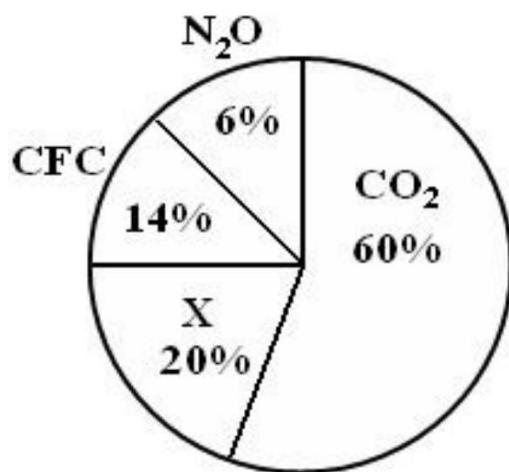
5 MARK QUESTIONS

1. A decade back, the enormous vehicular traffic in Delhi had made Delhi rank fourth amongst polluted cities of the world. Two measures taken by Delhi government brought marked improvement in air quality by 2005.
 - a) What were these two measures and how did they reduce air pollution?
 - b) What is the norm set by Euro II for petrol and diesel vehicles?
2. a) What is greenhouse phenomenon?
b) If greenhouse effect is not there, describe the situation which would be on the surface of Earth?
c) Over the past century temperature of earth has gone up. State four effects of the same.
d) How can we control global warming?
3. What is meant by ozone shield? Name two ozone depleting substances. How do the ozone depleting substances affect the ozone shield? Write one damaging effect of ozone depletion on humans and plants respectively.
4. Observe the given diagram and answer the questions which follow



- (a) What does the diagram show?
(b) Where is it usually used?
(c) How does it perform its main function?
(d) Why do we need to use it?
(e) What would happen if such equipment is not routinely used?
5. People's participation is the best method of Eco friendliness. How did the following people work out an ecological problem?
 - a) Amrita Devi Bishnoi
 - b) Ramesh Chandra Dagar
 - c) Ahmed Khan

6. A Fertilizer industry on banks of water resources discharges water in it.
- Which contaminants are likely to be added by it in the river?
 - Write its effect on water bodies and living organism in it.
 - Give the scientific term for this phenomenon.
 - How can Eco Scan toilets be help in conserving water?
- 7.
- What is polyblend?
 - How is advantageous over other plastics?
 - How would you dispose of the following :
 - Soiled cotton gauges from hospitals
 - Irreparable mobile phones
 - Uranium for nuclear reactors
 - Plastic waste
8. In the past two-three years coastal areas of the world have borne the devastating effects of Floods, due to global warming.
- Which environmental phenomenon is responsible for these catastrophic events?
 - The given figure gives relative contribution of some radioactive gases that are responsible for it. Fill the missing Gas (X).
 - How does CO₂ add to this effect?
 - What is the role of CFC in it?
 - Write two other dangerous changes that can occur due to global warming.



9. Mention two ways you can contribute to control global warming.
10. People have been actively participating in the efforts for the conservation of forests.
- Name the award instituted in respect of Amrita Devi to promote such efforts.
 - Name the movement launched to protect the trees by hugging them.
 - Name the step Government of India has undertaken in 1980's to work

closely with the local communities for protecting and managing forests.

11.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 initiative for water conservation. How?

12.What are the contribution of Ahmed Khan in Bangalore and Ramesh Chandra Dagar in Sonipat?



PERIODIC TEST - I (2022-23)

Subject: BIOLOGY

Max. Marks:35

Grade: XII

Time: 1 Hr 20 Mins

Name:

Section:

Roll No:

General Instructions:

- This question paper consists of 4 printed pages.
- All answers to be written in the answer sheet provided.
- All questions are compulsory.
- The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
- Section-A has 5 questions of 1 mark each.
- Section-B has 5 questions of 2 marks each.
- Section-C has 5 questions of 3 marks each.
- Section D has 1 question of 5 marks.
- Wherever necessary, neat and properly labeled diagrams should be drawn.

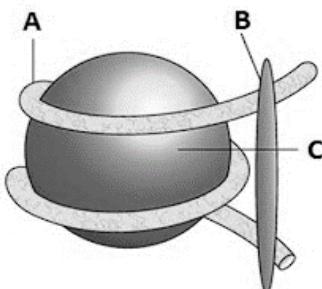
SECTION A

5

1. Select the odd one. Justify your answer: Adenosine, Guanosine, Cytosine, Thymidine.
 - a. Adenosine. Because it is purine. Others are pyrimidines.
 - b. Guanosine. Because it is purine. Others are pyrimidines.
 - c. Cytosine. Because it is nitrogen base. Others are nucleosides.
 - d. Thymidine. Because it is pyrimidine. Others are purines.
2. DNA of E. coli has
 - a. 4.6×10^6 bp
 - b. 6.6×10^9 bp
 - c. 5386 nucleotides
 - d. 48502 bp
3. In a DNA segment, cytosine is 18%. Calculate the percentage of other nitrogen bases.
 - a. Adenine= 36%, Guanine= 18%, Thymine= 36%.
 - b. Adenine= 18%, Guanine= 32%, Thymine= 32%.

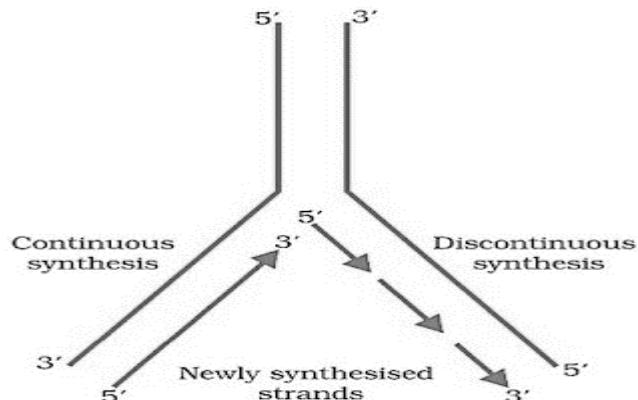
- c. Adenine= 32%, Guanine= 18%, Thymine= 32%.
- d. Adenine= 22%, Guanine= 38%, Thymine= 22%.

4. Observe the given diagram below. (a) Identify it. (b) Label A, B & C



- a. (a) Nucleosome. (b) A- DNA, B- H1 histone, C- Histone octamer
- b. (a) Nucleosome. (b) A- DNA, B- Histone, C- H1 histone
- c. (a) Nucleoid. (b) A- DNA, B- Histone octamer, C- H1 histone
- d. (a) Nucleoid. (b) A- DNA, B- H1 histone, C- Histone

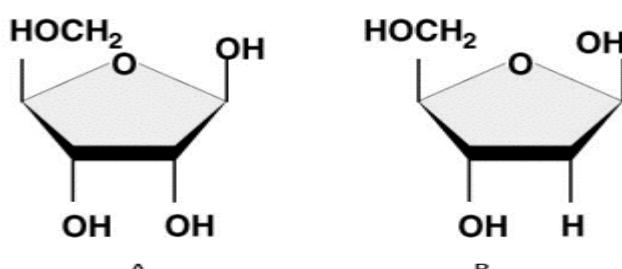
5. Analyze the given diagram. (a) What does it represent? (b) At which phase of the cell cycle this process takes place? (c) Name any two enzymes involved in this process.



- a. (a) Replication fork. (b) S-phase. (c) DNA polymerase & DNA ligase.
- b. (a) Replication fork. (b) G1-phase. (c) DNA polymerase & peptidyl transferase.
- c. (a) Transcription unit. (b) S-phase. (c) RNA polymerase & RNA primase.
- d. (a) Transcription unit. (b) G1-phase. (c) RNA polymerase I & RNA polymerase II.

SECTION B

6. Carefully examine structures A and B of pentose sugar given below. Which one is more reactive? Give reasons. 2



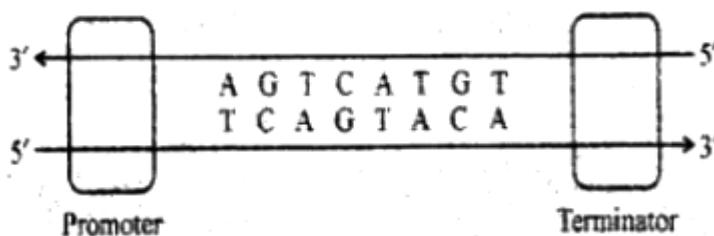
7. Rahim said that all codons coding amino acids are degenerate codons. (a) Do you agree with him? Why? (b) What do you understand by the term degenerate codons? 2
8. Give reasons for the discontinuous synthesis of DNA on one of the parental strands? 2

OR

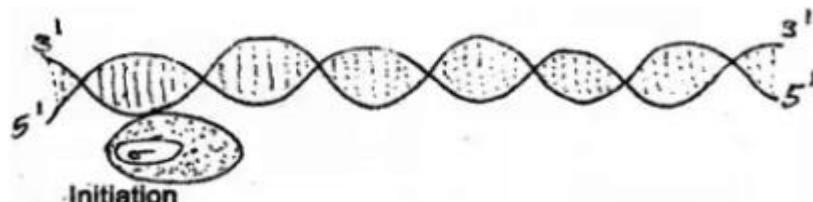
- a) Name the component of a nucleotide responsible for giving 5'—3' polarity to a polynucleotide.
- b) Where in a nucleotide is the glycosidic bond present?
9. What are the functions of the? 2
- a) Methylated guanosine cap
 - b) Poly-A tail
10. The sequence of a DNA strand representing a gene is given below. 2
- CACGTGGACTGAGGACTCCTC-5'
- (a) Is it coding strand or template strand? Justify.
 - (b) Construct the base sequence of mRNA transcribed from this. 3'-CACGTGGACTGAGGACTCCTC-5'

SECTION -C

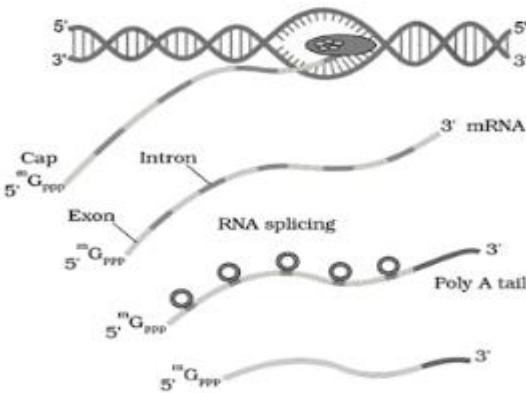
11. A transcriptional unit is given below. Observe it and answer the questions. 3



- (a) How can you identify the coding strand?
 - (b) Write the sequence of RNA formed from this unit?
 - (c) What would happen if both strands of the DNA act as templates for transcription?
12. Given below is the diagrammatic representation of first stage of a process in bacteria. 3



- (a) Identify the process.
 - (b) Name the enzyme catalyzes this process.
 - (c) What are the initiation and termination factors associated with RNA Polymerase in this transcription?
13. With the help of the Figure given, explain the processing of hnRNA to mRNA in eukaryotes. 3



- 14.** “Prediction of the sequence of amino acids from the nucleotide sequence in mRNA is very easy, but the exact prediction of the nucleotide sequence in mRNA from the sequence of amino acids coded by mRNA is difficult”. 3
- Which properties of the genetic code is the reason for the above condition? Explain.
 - Which are the stop codons in DNA replication?
- 15.** You are repeating the Hershey-Chase experiment and are provided with two isotopes ^{32}P and ^{15}N (in place of ^{35}S in the original experiment). How do you expect your results to be different? Name the 3 steps of this Experiment. 3

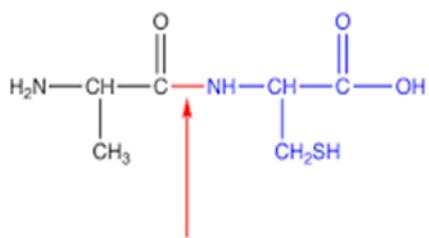
OR

What are the major enzymes of DNA replication? Give function of each.

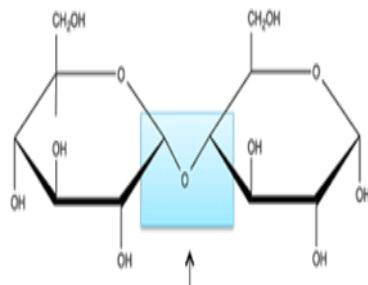
SECTION -D

- 16.** Read the following and answer any four questions from (i) to (v) given below: 5
- In prokaryotes, DNA is circular and present in the cytoplasm but in eukaryotes, DNA is linear and mainly confined to the nucleus. DNA or deoxyribonucleic acid is a long polymer of nucleotides. In 1953, the first correct double helical structure of DNA was worked out by Watson and Crick. Based on the X-ray diffraction data produced by Maurice Wilkins and Rosalind Franklin. It is composed of three components, i.e., A phosphate group, a deoxyribose sugar and a nitrogenous base. Different forms of DNA are B-DNA, Z-DNA, A-DNA, C-DNA and D-DNA.
- Name the linkage present between the nitrogen base and pentose sugar in DNA.
 - Phosphodiester bond (b) Glycosidic bond (c) Hydrogen bond (d) None of these
 - The double helix structure of DNA was proposed by
 - James Watson and Francis Crick (b) Erwin Chargaff (c) Frederick Griffith (d) Hershey and Chase
 - B-DNA which is right-handed double helix contains _____ base pairs per turn of the helix and each turn is _____ long.
 - 10, 3.4 Å (b) 10, 34 Å (c) 11, 20 Å (d) 11, 34 Å
 - Assertion: The two strands of DNA helix have uniform distance between them.
Reason: A large sized purine always paired opposite to a small sized pyrimidine.
 - Both assertion and reason are true and reason is the correct explanation of assertion.
 - Both assertion and reason are true but reason is not the correct explanation of assertion.
 - Assertion is true but reason is false.

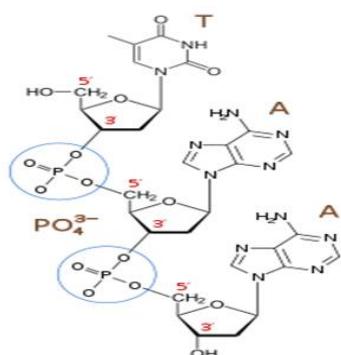
- (d) Both assertion and reason are false.
- (v) Which of the following describes the structure of phosphodiester bond?
- a)



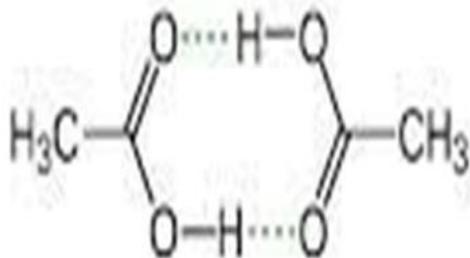
b)



c)



d)



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PT1/BIAK/1222/A

09-MAY-2022

PERIODIC TEST I (2022-23)

Answer Key- SET-1

Subject: BIOLOGY

Grade: XII

Max. Marks:35

Time: 1.5 Hrs

	SECTION A	
2.	a	
2.	a	
3	c	
4.	a	
5	a	
	SECTION B	
6.	<p>Sugar B is more reactive as it has hydroxyl group at 2' position. Explanation: The sugar A is deoxyribose sugar present in DNA and lack the hydroxyl group at 2' position. The sugar B is ribose sugar present in RNA and shows hydroxyl group at 2' carbon. This hydroxyl group makes it more reactive as this group can acts as a catalyst.</p>	2

	<p>The hydroxyl group can react with the other chemical compounds and can be converted into alkoxide ion that breaks the RNA structure.</p> <p>The presence of hydroxyl group makes the RNA as the primitive genetic material as its ability of fast replication and acts as a catalyst.</p>	
7.	<p>No. Because the codons AUG for methionine & UGG for tryptophan are not degenerate.</p> <p>(b) It is the phenomenon in which an amino acid is coded by more than one codon.</p>	2
8.	<p>The biological process of DNA synthesis naturally occurs in 5' to 3' direction. In the double-stranded DNA, the strands are parallel and antiparallel to each other. During the synthesis of DNA, both the strands act as templates and only one (3' to 5' direction) can synthesize the parallel strand in 5'→3' direction. The other strand 5' to 3' is synthesized in the opposite direction producing small stretches of DNA known as Okazaki fragments. This is the reason for the discontinuous synthesis of DNA on one of the parental strands.</p> <p style="text-align: center;">OR</p> <p>a) A polymer has at one end a free phosphate moiety at 5'- end of ribose sugar which is referred to as 5'-end of a polynucleotide chain. Similarly, at the other end of the polymer, the ribose has a free 3-OH group which is referred to as the 3'-end of a polynucleotide chain.</p> <p>b) A nitrogenous base is linked to pentose sugar through an N-glycosidic linkage to form nucleoside.</p>	2
9.	<p>a) Methylated guanosine cap plays a primary role in the attachment of the Mrna to the smaller sub-units of the ribosome during translation initiation.</p> <p>b) The Poly-A tail functions by increasing the length of the Mrna and also provides longevity to the Mrna</p>	2
10.	<p>(a) Template strand. Because it is in 3' to 5' direction. (b) 5'-GUG CAC CUG ACU CCU GAG GAG-3'</p>	2
SECTION -C		
11.	<p>(a) Coding strand has 5' end at the promoter or 5'TCAGTACA3'</p> <p>(b) 5' UCAGUACA 3'</p> <p>© The two RNA will be complimentary and may form double stranded RNA and it prevents the translation.</p>	3
12.	<p>.(a) Prokaryotic transcription</p> <p>(b) RNA polymerase</p> <p>©sigma and Rho factor.</p>	3
13.	<p>.(1) Splicing-the introns are removed, and exons are joined together.</p> <p>(2) capping -methyl guanosine triphosphate is added to the 5-end of hnRNA.</p> <p>(3) Tailing- adenylate residues (200-300) are added at 3-end in a template After these three processes, fully processed Mrna is released from nucleus into cytoplasm for protein synthesis.</p>	3
14.	<p>(a) Degeneracy – A single amino acid is represented by many codons (degenerate codons)</p> <p>(b) Stop codons are UAA, UAG, UGA</p>	3
15.	<p>1)The use of ^{15}N will not give any conclusive result because it is only a heavy isotope of nitrogen.</p> <p>2)In the original experiment, ^{35}S was detected only in the supernatant as it was incorporated in protein only, while ^{15}N will be incorporated into proteins as well as in DNA and hence it would appear both in the supernatant and in the sediment as well.</p>	3

	3)Infection, Blending ,Centrifugation OR a) DNA-dependent DNA polymerase- catalyzes the polymerization of deoxynucleotides, b) Okazaki fragments- joined together by DNA ligase. c) Helicases and topoisomerase enzymes – unwinding of the DNA helix.	
16.	1)b , 2 a), 3)-b-10, 34 Å 4) a 5)c	5



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PERIODIC TEST II (2022-23)

Subject: BIOLOGY

Grade: XII

Max. Marks:35

Time: 1.5

Hrs

Name:

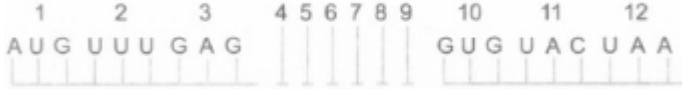
Section:

Roll No:

General Instructions:

- This question paper consists of 2 printed pages.
- All answers to be written in the answer sheet provided.
- All questions are compulsory.
- The question paper has four sections: Section A, Section B, Section C and Section D. There are 16 questions in the question paper.
- Section-A has 5 questions of 1 mark each.
- Section-B has 5 questions of 2 marks each.
- Section-C has 5 questions of 3 marks each.
- Section D has 1 question of 5 marks.
- Wherever necessary, neat and properly labeled diagrams should be drawn.

	SECTION A		5
3.	In an inducible operon, the genes are		
	a. usually not expressed unless a signal turns them "on"	b. usually expressed unless a signal turns them "off"	
	c. never expressed	d. always expressed	

2.	During transcription, if the nucleotide sequence of the DNA strand that is being coded is ATACG then the nucleotide sequence in the mRNA would be			
	a.	TATGC	b.	TCTGG
	c.	UAUGC	d.	UATGC
3.	A DNA with unequal nitrogen bases would most probably be			
	a.	single stranded	b.	double stranded
	c.	triple stranded	d.	four stranded.
4.	Expressed Sequence Tags (ESTs) refers to			
	a.	novel DNA sequences	b.	genes expressed as RNA
	c.	polypeptide expression	d.	DNA polymorphism
5.	A complex of ribosomes attached to a single strand of RNA is known as			
	a.	polypeptide	b.	Okazaki fragment
	c.	polysome	d.	polymer.
	SECTION B			
6.	How are the exons different from introns? Give two points of difference.			
7.	 <p>A hypothetical mRNA with 12 codons is shown above. (a) How many amino acids will be coded by this? Justify your answer. (b) Mention the dual functions of the codon, AUG.</p> <p style="text-align: center;">OR</p> <p>If the sequence of one strand of DNA is written as follows: 5'-ATGCATGCATGCATGCATGCATGCATGC-3' Write down the sequence of complementary strand in 5' → 3' direction</p>			
8.	State two functions of tRNA as an adaptor molecule.			
9.	a. Write the full form of VNTR. b. How is VNTR different from 'Probe'?			
10.	(a) In human genome which one of the chromosomes has the most genes and which one has the fewest? (b) Scientists have identified about 1.4 million single nucleotides polymorphism in human genome. How is the information of their existence going to help the scientist?			
	SECTION -C			
11.	a) What was the objective of the following experiment? b) Who performed it? c) How was the DNA separated into different layers? d) Name any other scientist who had performed experiment to prove the same.			

12.	(a) State the arrangement of different genes that is seen in bacteria referred to as 'operon'. (b) Draw a schematic labeled illustration of lac operon in a switched-on state. (c) Describe the role of lactose in lac operon.	3
13.	In bacteria, since the mRNA does not require any processing to become active, and also since transcription and translation take place in the same compartment (there is no separation of cytosol and nucleus in bacteria), many times the translation can begin much before the mRNA is fully transcribed. Consequently, the transcription and translation can be coupled in bacteria. In eukaryotes, there are two additional complexities. What are they? Explain in detail.	3
14.	Explain the process of translation, leading to polypeptide formation OR Describe the salient features of genetic code.	3
15.	What was the objective of the following experiment? What was the conclusion after this experiment? Write the results of the experiment A-D. 	3
	SECTION -D	
16.	Read the following and answer the questions given below: DNA profiling (DNA fingerprinting) is a technique employed by forensic scientists to assist in the identification of individuals by their respective DNA profiles. DNA profiling should not be confused with full genome sequencing. Every individual in the	5

world can be identified at the molecular level on the basis of an extremely high level of polymorphism in the sequence of his or her DNA, which he or she inherits from his or her biological parents and is identical in every cell of the body. Although 99.9% of human DNA sequences are the same in every person, enough of the DNA is different that it is possible to distinguish one individual from another, unless they are monozygotic twins. DNA profiling uses repetitive sequences that are highly variable called variable number tandem repeats (VNTRs) in particular short tandem repeats (STRs). VNTRs loci are very similar between closely related humans, but are so variable that unrelated individuals are extremely unlikely to have the same VNTRs. The application of DNA profiling in the criminal justice system is an important issue in criminal investigators today. The technology is changing rapidly and several new techniques are becoming available. DNA profiling has been described as a powerful breakthrough in forensic science. The forensic use of DNA profiling is a major contribution to a technology which can help not only in including the culprit but also to exclude the innocent.

- a. Name the Scientist who developed DNA Finger printing technique.
- b. Following a severe accident, many charred-disfigured bodies are recovered from the site making the identification of the dead very difficult. Name and explain the technique that would help the authorities to establish the identity of the dead to be able to handover the dead to their respective relatives.
- c. DNA polymorphism is the basis of DNA fingerprinting technique. Explain.



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PERIODIC TEST II ANSWER KEY (2022-23)

Subject: BIOLOGY

Grade: XII

Max. Marks:35

Time: 1.5

Hrs

Name:

Section:

Roll No:

	SECTION A		5
1.	a		
2.	a		
3.	c		
4.	b		

5.	c	
	SECTION B	
6.	(1)Exons are coding sequences that forms part of mRNA,Introns are non -coding sequences that do not become part of mRNA.(2) Exons are joined together during splicing to make the information continuous, Introns are removed during splicing.	1+1
7.	a. 11 -Last one being the stop codon b. Start codon and codes for Methionine. OR The DNA strands are complementary to each other with respect to base sequence. Hence, if the sequence of one strand of DNA is 5'- ATGCATGCATGCATGCATGCATGC - 3' Then, the sequence of complementary strand in $5' \text{ to } 3'$ direction will be 3'- TACGTACGTACGTACGTACGTACGTACG - 5' Therefore, the sequence of nucleotides on DNA polypeptide in $5' \text{ to } 3'$ direction is 5'- GCATGCATGCATGCATGCATGCATGCAT - 3'	1+1
8.	(1)It has amino acid binding site at 3' end .(2)It has anticodon to recognize the codon on mRNA for the amino acid.	1+1
9.	a. VNTR: Variable Number of Tandem Repeats. 1 mark Probe- is labeled/radioactive (single stranded hybridized DNA fragments). 1 mark	1+1
10.	a. Chromosome 1 has most genes and Y has fewest.1 mark b. This information promises to revolutionize the processes of finding chromosomal locations for disease associated sequence. /Tracing human history. 1marks	1+1
	SECTION -C	
11.	a) What was the objective of the following experiment? -To prove that DNA replication is semi conservative b) Who performed it-Messelson and Stahl c) How was the DNA separated into different layers? -Based on density by centrifugation d) Name any other scientist who had performed experiment to prove the same. Very similar experiments involving use of radioactive thymidine to detect distribution of newly synthesised DNA in the chromosomes was performed on <i>Vicia faba</i> (faba beans) by Taylor and colleagues in 1958.	1+1/2 +1+1/ 2
12.	a. polycistronic structural gene/ three structural genes adjacent to, an operator, a promoter, and a regulator. b.	1+1+1
	<p style="text-align: center;">In presence of inducer</p> <p>Transcription $\frac{1}{2}$</p> <p>Translation $\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>Inducer</p> <p>(Inactive repressor)</p>	

	c. Lactose is the inducer that inactivates repressor, this allows RNA polymerase access to the promoter, to initiate transcription of the natural gene or switch the fan also there.	
13.	<p>In eukaryotes, there are two additional complexities –</p> <p>(i) There are at least three RNA polymerases in the nucleus (in addition to the RNA polymerase found in the organelles). There is a clear cut division of labour. The RNA polymerase I transcribes rRNAs (28S, 18S, and 5.8S), whereas the RNA polymerase III is responsible for transcription of tRNA, 5srRNA, and snRNAs (small nuclear RNAs). The RNA polymerase II transcribes precursor of mRNA, the heterogeneous nuclear RNA (hnRNA).</p> <p>(ii) The second complexity is that the primary transcripts contain both the exons and the introns and are non-functional. Hence, it is subjected to a process called splicing where the introns are removed and exons are joined in a defined order. hnRNA undergoes additional processing called as capping and tailing. In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA. In tailing, adenylate residues (200-300) are added at 3'-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation (Figure 6.11).</p>	1+1+
14.	<p>For initiation, the ribosome binds to the mRNA at the start codon (AUG) that is recognised only by the initiator tRNA. The ribosome proceeds to the elongation phase of protein synthesis. During this stage, complexes composed of an amino acid linked to tRNA, sequentially bind to the appropriate codon in mRNA by forming complementary base pairs with the tRNA anticodon. The ribosome moves from codon to codon along the mRNA. Amino acids are added one by one, translated into Polypeptide sequences dictated by DNA and represented by mRNA. At the end, a release factor binds to the stop codon, terminating translation and releasing the complete polypeptide from the ribosome.</p> <p>OR</p> <p>composed of mRNA base triplets; called codons; 64 different codons; each codes for the addition of an amino acid to a growing polypeptide chain; the genetic code is degenerate; meaning more than one codon can code for a particular amino acid; the genetic code is universal; meaning it is the same in almost all organisms; (AUG is the) start codon; some (nonsense) codons code for the end of translation.(6*1/2)</p>	2+1
15.	<p>Objective- to find out which biomolecule is the genetic material(1/2 mark)</p> <p>DNA is the genetic material-1/2 mark</p> <p>A-Survives B-Dies C-Survives D-Dies (2 marks)</p>	3
SECTION -D		
16.	<p>a. Alec Jeffreys</p> <p>b. To find out the identity of the dead person to handover him to his respective relatives we perform DNA fingerprinting of both, i.e. the dead person and their relatives. This is done because DNA fingerprinting uses short nucleotide repeats called Variable Number of Tandem Repeats (VNTRs) as markers. VNTRs vary from person to person and are inherited from one generation to the next. And only closely related</p>	1+2+2

- individuals have similar VNTRs
- c. (i)DNA polymorphism It Is the occurrence of inheritable mutations at a frequency greater than 0.01 in a population.
- (a)Such variations often occur in non-coding sequences. They keep on accumulating generation after generation.
- (b)Types of polymorphism range from single nucleotide change to very large scale changes.
- (c)Single nucleotide polymorphism is used to diagnose disease related sequences of DNA on the chromosome.
- (d)Variable number of tandem repeats show a high degree of polymorphism.



Half Yearly Examination 2022-23

Subject: Biology

Grade: XII

Max. Marks:70

Time: 3 hrs

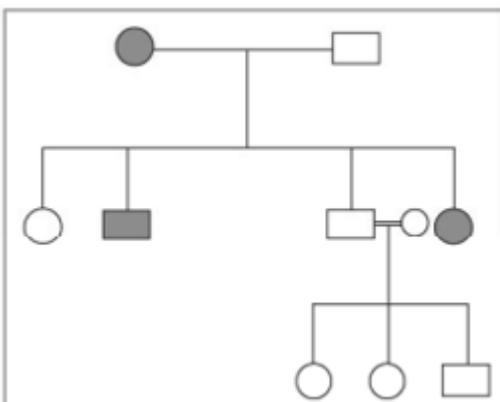
General Instructions: -

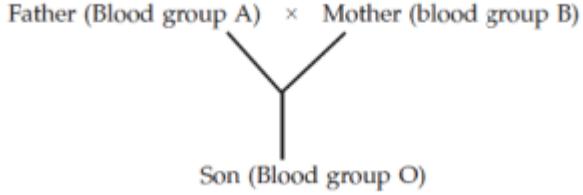
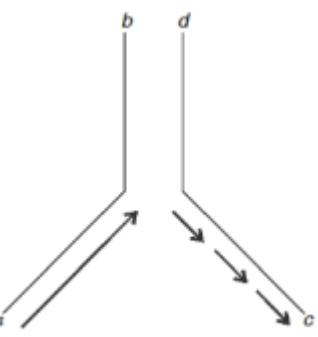
- All questions are compulsory.
- The question paper has five sections and 32 questions. All questions are compulsory.
- Section–A has 5 questions of 1 mark each; Section–B has 5 questions of 1 mark each; and Section–C has 10 questions of 2 marks each and Section D has five questions of 3 marks each and Section E has 2 case-based question of 5 marks each.
- There is no overall choice. However, internal choices have been provided in some questions. A student must attempt only one of the alternatives in such questions.
- Wherever necessary, neat and properly labelled diagrams should be drawn.

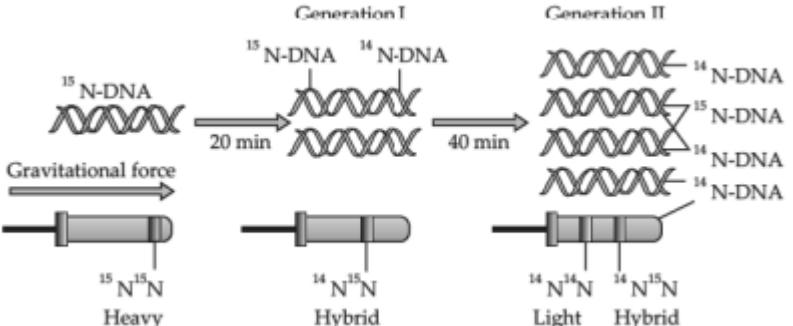
SECTION A

1	Gene of bacteria code for more than one polypeptide are called (a) overlapping gene (b) monocistronic gene (c) polycistronic gene (d) non-ambiguous gene	1
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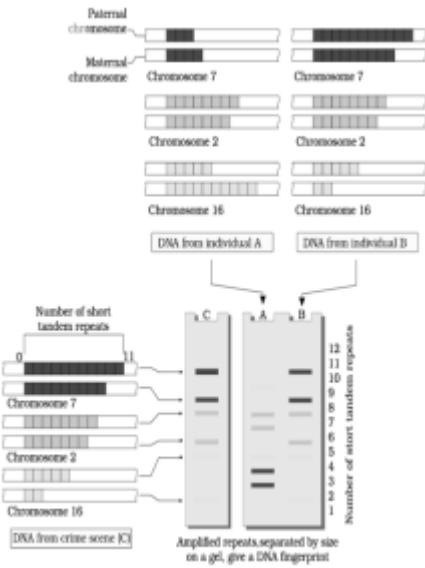
2	During replication of DNA Okazaki fragments are formed in the direction- (a) 5'→3' (b) 3'→ 5' (c) 3'→ 3' (d) 5'→ 5'	1
3	The graphical representation to calculate the probability of all possible genotypes of offspring in a genetic cross, is called (a) pedigree analysis (b) karyotype (c) Punnet square (d) Chromosome map	1
4	Assertion : The genetic complement of an organism is called genotype Reason : Genotype is the type of hereditary properties of an organism Mark the correct choice as: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.	1
5	Assertion : Mendel was successful in knowing the process of inheritance Reason : He considered a single character at a time Mark the correct choice as: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.	1
SECTION B		
6	What are autosomes?	1
7	The gene I that controls ABO blood grouping in human beings has three alleles I^A , I^B and i. (a) How many different genotypes are possible? (b) How many phenotypes are possible?	1
8	In the following pedigree chart, state whether the trait is autosomal dominant, autosomal recessive or sex linked. Give reason for your answer.	1



9	List two essential roles of ribosome for translation.	1
10	In medium where E coli was growing lactose was added, which induced the lac operon. But why does lac-operon shut down after some time after addition of lactose in the medium.	1
	SECTION C	
11	Name any one plant and its feature that shows the phenomenon of incomplete dominance.	2
12	Study the following cross and answer the following questions. Father (Blood group A) \times Mother (blood group B)  (a) Write the genotypes of father, mother and son. (b) What is the type of dominance in human ABO blood grouping?	2
13	Write four symptoms of Turner's syndrome.	2
14	Distinguish between heterochromatin and euchromatin.	2
15	Mention the polarity of the DNA strands a-b and c-d shown in the replicating fork given below. 	2
16	What will be the phenotypes of F1 generation when a normal vision man (XY) marries a color blind woman(X^cX^c)?	2
17	Write a short note on Klinefelter's syndrome. OR Give reason why human skin color is observed in different shades.	2

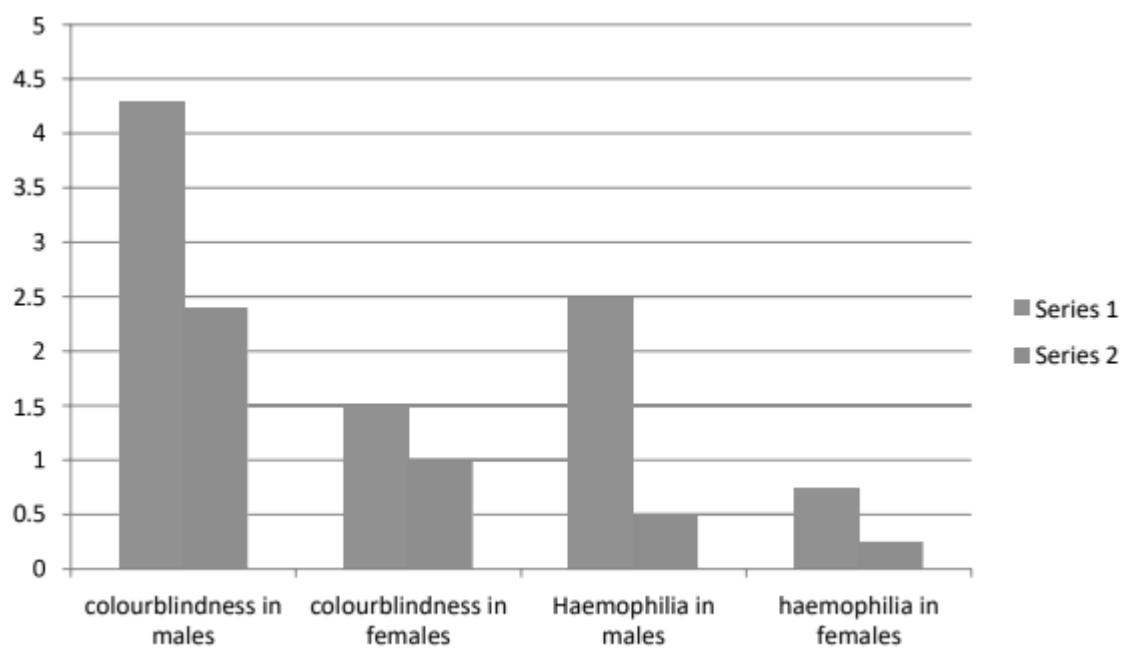
1 8	Why hnRNA is required to undergo splicing?	2																								
1 9	DNA is the more suitable genetic material over RNA. Why?	2																								
2 0	Results of famous experiment is given in the figure. (a) Identify the experiment. (b) Which property of the DNA is proved by this experiment?	2																								
																										
SECTION D																										
2 1	What is Pedigree analysis? Write its advantages.	3																								
2 2	Study the table and answer the questions:	3																								
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>RY</th> <th>Ry</th> <th>rY</th> <th>ry</th> </tr> </thead> <tbody> <tr> <td>RY</td> <td>RRYY RRYy RrYY RrYy</td> <td>RRYy RRyy RrYy Rryy</td> <td>RrYY RrYy rrYY rrYy</td> <td>RrYy Rryy rrYy rryy</td> </tr> <tr> <td>Ry</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>rY</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>ry</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>a) Name the dominant traits b) What was the parent genotype if the table shows F2 generation? c) What is the F2 phenotype ratio? Why did you get such type of ratio?</p>	RY	Ry	rY	ry	RY	RRYY RRYy RrYY RrYy	RRYy RRyy RrYy Rryy	RrYY RrYy rrYY rrYy	RrYy Rryy rrYy rryy	Ry					rY					ry					
RY	Ry	rY	ry																							
RY	RRYY RRYy RrYY RrYy	RRYy RRyy RrYy Rryy	RrYY RrYy rrYY rrYy	RrYy Rryy rrYy rryy																						
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ry																										
2 3	In peas tallness is dominant over dwarfness, and red color of flowers is dominant over the white color. When a tall plant bearing red flowers was pollinated by a dwarf plant bearing white flowers, the different phenotypic groups were identified in the progeny in numbers mentioned against them. Tall Red=138 Tall white=132 Dwarf Red=136 Dwarf white=128 Mention the genotypes of the two parents and of the types of four offspring.	3																								
2 4	Read the sequence of the nucleotides in the given segment of mRNA and the respective amino acid sequence in the polypeptide chain. (a) Provide the triplet of bases for i) Valine and ii) Proline (b) Write the nucleotide sequence of the DNA strand from which this mRNA was transcribed (c) What does the last codon of this RNA stand for?	3																								

2 5	Why is Human Genome Project called a mega project?	3
2 6	It is said that the harmful alleles get eliminated from population over period of time, yet sickle cell anemia is persisting in human population. Why? OR In a Mendelian monohybrid cross, the F ₂ generation shows identical genotypic and phenotypic ratios. What does it tell us about the nature of alleles involved? Justify your answer.	3
2 7	What is Down's syndrome? Give its symptoms and cause. Why is that the chances of having a child with Down's syndrome increases if the age of the mother exceeds forty years?	3
2 8	With the help of a diagram describe the transcription unit of DNA.	3
2 9	Who postulated an adapter molecule to link the genetic code and the amino acids? State its two functions. OR (a) What are the four levels at which gene expression is regulated in eukaryotic cell ? (b) Name the regulatory gene of Lac -operon .	3
3 0	Study the diagram given below. Name the linkage X,Y,Z and the respective molecules formed by them.	3
	SECTION E (Case Based)	
3 1	Study the following crime case in which DNA finger print of two individual suspects A and B obtained from their DNA sample and DNA sample from the crime scene is given as DNA fingerprint C to answer the following questions:	5



- (a) Name the technique to obtain separate bands of DNA fragments.
 (b) Name the DNA in which the tandem repeats are found.
 (c) Write the steps followed to obtain a DNA finger print.
 (d) Is it right to compare the VNTR of chromosome no 16 of C with the chromosome no 7 of the suspects

3
 2 The chances of color blindness about 8 % of males and only about .4 % of females. This is because the genes that lead to red, green color blindness are on the X chromosome. Males have only one X chromosome and females have 2. Another sex-linked recessive disease, which shows its transmission from unaffected carrier female to some of the male progeny has been widely studied. In this disease a single protein that is a part of the cascade of proteins involved in the clotting of the blood is affected. Due to this in an affected individual a simple cut will result in nonstop bleeding. The heterozygous female (carrier) for hemophilia may transmit the disease to sons. The possibility of a female becoming a hemophiliac is extremely rare because mother of such a female has to be at least carrier and the father should be hemophiliac.



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

- a) Give any two reasons for low viability of human females with hemophilia
- b) Males are mostly affected with both the disorders. Why?
- c) How carrier mother may not inherit color blindness to her offspring
- d) Which two colors cannot be identified in the color blindness condition?



مدرسہ دلھی الخاصہ ذ.م.م.

DELHI PRIVATE SCHOOL L.L.C.

Affiliated to C.B.S.E., DELHI

ANSWER KEY-Half Yearly Examination 2022-23

Subject: Biology

Grade: XII

Max. Marks:70

Time: 3 hrs

SECTION A

1	a	1
2	b	1
3	c	1
4	b	1
5	a	1

SECTION B

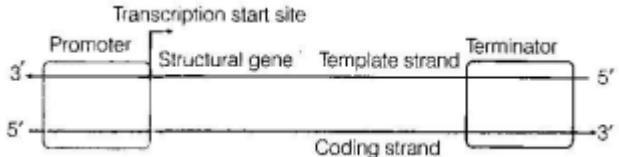
6	Chromosomes other than sex chromosomes.	1
7	a-6,b-4	1
8	Autosomal dominant-1/2, Never skips a generation-1/2	1
9	(i) When the small sub-unit encounters an mRNA, the process of translation of mRNA to protein begins. (ii) Two sites exist in large subunit of ribosome for subsequent amino acids to bind to and this be close enough to each other for formation of peptide bond. Ribosome functions as a catalyst (23srRNA in bacteria is enzyme – ribozyme) for synthesis of peptide bond.	1
10	After addition of lactose complete breakdown of lactose to glucose and galactose takes place . Therefore there is no more lactose to bind to the repressor protein and the lac operon shuts down.	1

SECTION C

11	<i>Mirabilis jalapa</i> /antirrhinum/dog flower- the flower colour-1 Mark Explanation-1 Mark	2
----	---	---

12	(a) Genotype of Father with Blood Group 'A' — $I^A I^A$, $I^A i$ Genotype of Mother with Blood group 'B' — $I^B I^B$, $I^B i$ Genotype of Son with Blood Group 'O'— ii. (b) Co-dominance.	1/2*4	2																					
13	1)sterile female 2)poorly developed breast 3)short stature. 4) small uterus		2																					
14	<table border="1"> <thead> <tr> <th>Character</th> <th>Heterochromatin</th> <th>Euchromatin</th> </tr> </thead> <tbody> <tr> <td>1. Amount of stain</td> <td>Darkly stained.</td> <td>Lightly stained.</td> </tr> <tr> <td>2. Chromatin</td> <td>Condensed regions of chromatin fibres.</td> <td>Less tightly coiled regions of fibres.</td> </tr> <tr> <td>3. Transcription</td> <td>Transcriptionally inactive or less active.</td> <td>Transcriptionally active.</td> </tr> <tr> <td>4. Effect of environmental factors</td> <td>Less affected by temperature, sex or age. It is not acetylated.</td> <td>More affected by temperature, age. It is acetylated during in High.</td> </tr> <tr> <td>5. Frequency of cross over</td> <td>Low due to more condensed DNA, so protects the vital genes.</td> <td></td> </tr> <tr> <td>6. Replication</td> <td>Late replicating.</td> <td>Early replicating</td> </tr> </tbody> </table>	Character	Heterochromatin	Euchromatin	1. Amount of stain	Darkly stained.	Lightly stained.	2. Chromatin	Condensed regions of chromatin fibres.	Less tightly coiled regions of fibres.	3. Transcription	Transcriptionally inactive or less active.	Transcriptionally active.	4. Effect of environmental factors	Less affected by temperature, sex or age. It is not acetylated.	More affected by temperature, age. It is acetylated during in High.	5. Frequency of cross over	Low due to more condensed DNA, so protects the vital genes.		6. Replication	Late replicating.	Early replicating		2
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15	a-b=3'-5',c-d=5'-3'		2																					
16	Color blind man($X^c Y$),Normal man(XY),two carrier women($X^c X$)		2																					
17	<p style="text-align: center;">Klinefelter's syndrome</p> <p>44 + XXY Male Underdeveloped testes, dysgenesis of seminiferous tubules, no spermatogenesis, sterile, mentally retarded. Also has some female characters like gynaecomastia, presence of sex chromatins.</p> <p>(1+1)</p>		2																					
	OR																							
	Human skin colour is controlled by at least three gene pairs. Every gene shows the quantitative effect. Darker colour is proportional to presence of number of dominant genes in person.																							
18	hnRNA contains both coding and non coding sequences called exons and introns respectively.The introns need to be removed to make it functional mRNA.so splicing is needed.		2																					
19	DNA-Chemically less reactive and structurally more stable-factors that make DNA more stable.		2																					
20	(a) The given diagram is representing "Meselson and Stahl's experiment". It is proven that DNA replicates semi- (b) The strands of DNA are of intermediate density. The double stranded DNA is $\frac{1}{2}$ Heavy and $\frac{1}{2}$ Light.		2																					
	SECTION D																							
21	It is a system to study the distribution and movement of traits in a series of generation in a family. Sex linked disorders like Haemophilia and colour blindness will be identified and treated by Pedigree .		3																					
22	Round and Yellow,Parents-RrYy,9:3:3:1,Reason-Law of independent assortment.		3																					

23	<p>Four types of offspring are in a ratio of 1 : 1 : 1 : 1. Such a result is obtained in a test-cross progeny of a dihybrid cross.</p> <p>The cross can be shown as:</p> <p>Tall & Red (Tt Rr) × Dwarf & white (ttrr)</p> <table border="1"> <thead> <tr> <th>Offsprings</th><th>Gametes</th><th>tr</th></tr> </thead> <tbody> <tr> <td>Tt Rr – Tall, Red</td><td>TR</td><td>TtRr</td><td>Tall</td><td>Red</td></tr> <tr> <td>Tt rr – Tall, White</td><td>Tr</td><td>Ttrr</td><td>Tall</td><td>White</td></tr> <tr> <td>Tt Rr – dwarf, red</td><td>tR</td><td>ttRr</td><td>dwarf</td><td>Red</td></tr> <tr> <td>tt rr – dwarf, white.</td><td>tr</td><td>ttrr</td><td>dwarf</td><td>white</td></tr> <tr> <td>Ratio</td><td></td><td colspan="3">1 : 1 : 1 : 1</td></tr> </tbody> </table>	Offsprings	Gametes	tr	Tt Rr – Tall, Red	TR	TtRr	Tall	Red	Tt rr – Tall, White	Tr	Ttrr	Tall	White	Tt Rr – dwarf, red	tR	ttRr	dwarf	Red	tt rr – dwarf, white.	tr	ttrr	dwarf	white	Ratio		1 : 1 : 1 : 1			3
Offsprings	Gametes	tr																												
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24	<p>Valine : GUU; Proline : CCU</p> <p>Nucleotides of DNA strand : TAC AAA TAC GGA CAA AGA ATT</p> <p>UAA : Stop.</p>	3																												
25	<p>Human genome project was aimed to determine the complete base sequence of human DNA.</p> <p>Human genome project is called a mega project because</p> <ul style="list-style-type: none"> (i) Its aim was to determine the nucleotide sequence of complete human genome which was a task of enormous magnitude. (ii) a total of 3×10^9 base pairs were to be sequenced and the cost was about 9 billion US dollars. (iii) it required bioinformatics data base techniques and other contemporary devices for the analysis, storage and retrieval of information. (iv) many countries worked jointly to complete this timed project. 	3																												
26	<p>In sickle cell anaemia, heterozygous condition is beneficial in malaria infected regions because malarial parasite is not able to pass into RBCs bearing Hb^A Hb^S haemoglobin. Due to this, allele is able to persist, which is due to balanced polymorphism or Heterozygote selection or balanced selection.</p> <p>OR</p> <p>In case of incomplete dominance monohybrid cross shows F₁ pink flowers (Rr) when in Snapdragon Red flowered (RR) and white flowered (rr) parents are crossed.</p> <p>In F₂ generation genotypic and phenotypic ratio are same. For example:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">Red RR</th> <th style="text-align: center;">White rr</th> <th style="text-align: center;">----</th> <th style="text-align: center;">Phenotype Genotype</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Rr (Pink)</td> <td style="text-align: center;">rr</td> <td style="text-align: center;">----</td> <td style="text-align: center;">F₁</td> </tr> <tr> <td style="text-align: center;">R, r</td> <td style="text-align: center;">----</td> <td style="text-align: center;">-----</td> <td style="text-align: center;">Gametes</td> </tr> <tr> <td style="text-align: center;">R, r</td> <td style="text-align: center;">X</td> <td style="text-align: center;">R, r</td> <td style="text-align: center;">----</td> </tr> <tr> <td style="text-align: center;">RR Red</td> <td style="text-align: center;">Rr Pink</td> <td style="text-align: center;">Rr Pink</td> <td style="text-align: center;">rr White</td> </tr> </tbody> </table> <p>Same phenotypes and genotypes.</p>	Red RR	White rr	----	Phenotype Genotype	Rr (Pink)	rr	----	F ₁	R, r	----	-----	Gametes	R, r	X	R, r	----	RR Red	Rr Pink	Rr Pink	rr White	3								
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27	<p>A medical term for having an extra copy of a chromosome is 'trisomy.' Down syndrome is also referred to as Trisomy 21. This extra copy changes how the baby's body and brain develop, which can cause both mental and physical challenges for the baby.</p>	3																												

	The chances of bearing child with Down's Syndrome are more with increase in age of mother (+ 40). Older cells in mothers (+ 40) are more for chromosomal non-disjunction. Mother bears ova. Chances of non-disjunction are more in mother due to many physico-chemical exposures during her life time.	
28	Explanation-2 marks,Diagram-1 Mark 	3
29	Francis Crick postulated tRNA as an adapter molecule.(1)It has amino acid binding site at 3' end .(2)It has anticodon to recognize the codon on mRNA for the amino acid. OR a.Transcription level, Processing level ,Transport of mRNA to cytoplasm , Translation level. b. Gene i . ½*4+1	3
30	X : N-glycosidic linkage. Y : Phosphoester linkage. Z : 3'-5' phosphodiester linkage. X forms nucleoside. Y forms nucleotide. Z forms polynucleotide. (1/2 × 6)	3
SECTION E (Case Based)		
31	(a) Gel Electrophoresis (1) (b) Satellite DNA (1) (c) Isolating the DNA. ↓ Digesting the DNA with the help of restriction endonuclease enzymes. ↓ Separating the digested fragments as per the fragment size by the process of electrophoresis. ↓ Blotting the separated fragments onto synthetic membranes like nylon. ↓ Hybridising the fragments using labelled VNTR probes. ↓ Analysing the hybrid fragments using autoradiography. (2) (d) No (1)	5

32	<p>(a) Non clotting of the blood / Loss of major volume of blood during menstruation/ Lack of the coagulating protein(1)</p> <p>(b) Males have only one X chromosome and one Y chromosome, so if they inherit a copy of the faulty X chromosome that carries hemophilia from their mother, they will develop the disorder. (2)</p> <p>(c) Affected gene is only found on one X chromosome. Mother may inherit normal X chromosome to the new generation. Offsprings will be heterozygous genotype.(1)</p> <p>(d) Red and green(1)</p>	5
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مَدْرَسَةُ دَلْهِيِّ الْخَاصَّةُ ذَ.مَ.م .
DELHI PRIVATE SCHOOL L.L.C.
Affiliated to C.B.S.E., DELHI

Pre Board 1 Examination 2022-23

General Instructions: -

- (i) All questions are compulsory.
- (ii) The question paper has five sections and 33 questions. All questions are compulsory.
- (iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
- (iv) There is no overall choice. However, internal choices have been provided in some questions.
A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION A		
1	Method of DNA replication in which two strands of DNA separate and synthesize new strands (a) dispersive (b) conservative (c) semi-conservative (d) non conservative	1
2	In the genetic code dictionary, how many codons are used to code for all the 20 essential amino acids ? (a) 20 (b) 64 (c) 60 (d) 61	1
3	Jacob and Monod studied lactose metabolism in E. coli and proposed operon concept. Operon concept is applicable for (a) all prokaryotes (b) all prokaryotes and some eukaryotes (c) all prokaryotes and all eukaryotes (d) all prokaryotes and some protozoans.	1
4	Which of the following statements is not correct? (a) Pollen germination and pollen tube growth are regulated by chemical components of pollen interacting with those of the pistil. (b) Some reptiles have also been reported as pollinators in some plant species. (c) Pollen grains of many species can germinate on the stigma of a flower, but only one pollen tube of the same species grows into the style. (d) Insects that consume pollen or nectar without bringing about pollination are called pollen/ nectar robbers	1
5	The figure below shows three steps (A, B, C) of Polymerase Chain Reaction (PCR). Select the option giving correct identification together with what it represents?	1

	<p>A. Region to be amplified</p> <p>B.</p> <p>C.</p>	
	<p>(a) B - denaturation at a temperature of about 98°C separating the two DNA strands (b) A - denaturation at a temperature of about 50°C (c) C - extension in the presence of heat stable DNA polymerase (d) A - annealing with two sets of primers</p>	
6	<p>A normal woman, whose father was colour blind is married to a normal man. The sons would be:</p> <p>(a) 75% colour-blind (b) 50% colour-blind (c) all normal (d) all colour-blind</p>	1
7	<p>Read the following four statements (A-D) about certain mistakes in them.</p> <p>(A) The first transgenic cow, Rosie produced milk which was human alpha-lactalbumin enriched. (B) Restriction enzymes are used in isolation of DNA from other macromolecules. (C) Downstream processing is one of the steps of rDNA technology. (D) Disarmed pathogen vectors are also used in transfer of rDNA into the host.</p> <p>Which of the statements have mistakes?</p> <p>(a) B and C (b) C and D (c) A and C (d) Only B</p>	1
8	<p>The figure given below depicts a diagrammatic sectional view of the human female reproductive system.</p> <p>Which set of three parts out of I-VI have been correctly identified?</p> <p>(a) (II) endometrium, (III) infundibulum, (IV) fimbriae (b) (III) infundibulum, (IV) fimbriae, (V) cervix</p>	1

	(c) (IV) oviducal funnel, (V) uterus, (VI) cervix (d) (I) perimetrium, (II) myometrium, (III) Fallopian tube	
9	The technique called Gamete Intra Fallopian Transfer (GIFT) is recommended for those females (a) who cannot produce an ovum (b) who cannot retain the foetus inside uterus (c) whose cervical canal is too narrow to allow passage for the sperms (d) who cannot provide suitable environment for fertilization	1
10	Which one of the following represents a palindromic sequence in DNA? (a) 5'-GAATTC-3' 3' - CTTAAG - 5' (b) 5'-CCAATG-3' 3' - GAATCC - 5' (c) 5' - CATTAG - 3' 3 - GATAAC - 5' (d) 5' - GATACC - 3' 3' - CCTAAG - 5'	1
11	In RNAi, the genes are silenced using: (a) ds-RNA (b) ss-DNA (c) ss-RNA (d) ds-DNA	1
12	Select the correct sequence for transport of sperm cells in male reproductive system. (a) Testis → Epididymis → Vasa efferentia → Vas deferens → Ejaculatory duct → Inguinal canal → Urethra → Urethral meatus (b) Testis → Epididymis → Vasa efferentia → Rete testis → Inguinal canal → Urethra (c) Seminiferous tubules → Rete testis → Vasa efferentia → Epididymis → Vas deferens → Ejaculatory duct → Urethra → Urethral meatus (d) Seminiferous tubules → Vasa efferentia → Epididymis → Inguinal canal → Urethra	1
	Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below: A. Both A and R are true and R is the correct explanation of A. B. Both A and R are true and R is not the correct explanation of A. C. A is true but R is false. D. A is False but R is true.	
13	Assertion : Flowers are the structures related to sexual reproduction in flowering plants. Reason : Various embryological processes of plants occur in a flower.	1
14	Assertion : Corpus luteum degenerates in the absence of fertilization. Reason : Progesterone level decreases.	1
15	Assertion : Introduction of sex education in schools should be encouraged. Reason : This will encourage children to believe in myths about sex related aspects.	1
16	Assertion : RNAi is silencing of a specific tRNA. Reason : Cellular defence mechanism in eukaryotes is RNAi.	1
	SECTION B	
17	(a) Name two organisms where males are heterogametic. (b) Write the scientific name of garden pea.	2
18	State two differences between Perisperm and Pericarp.	2

1 9	Comment on Reproductive and Child health care programme of the government to improve reproductive health of the people.	2
2 0	What are the major functions of male accessory ducts?	2
2 1	Define biotechnology. Name two principles of biotechnology. OR Since DNA is a hydrophilic molecule, it cannot pass through cell membranes. Name and explain the technique with which the DNA is forced into (i) a bacterial cell (ii) a plant cell (iii) an animal cell.	2
SECTION C		
2	A tRNA is charged with the amino acid methionine.	
2	(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.	3
2 3	In Mendel's breeding experiment on garden pea, the offspring of F ₂ 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 F ₁ generation. (iii) Work out the cross.	3
2 4	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.	3
2 5	When the pollen is transferred from anther to stigma of same flower, the pollination is called autogamy. (a) Cleistogamous flowers are invariably autogamous. Explain (b) Geitonogamy is functionally cross pollination, but genetically similar to autogamy. Why? (c) List any two strategies a plant with chasmogamous flower can evolve to prevent self pollination.	3
2 6	a) Write a short note on egg apparatus. b) What is triple fusion?	3
OR		
	Starting with the zygote, draw the diagrams of the different stages of embryo development in a dicot.	
2 7	Draw a labelled diagram of human sperm.	3
2 8	Describe the methods of birth control by which fertilization of ovum by sperm is prevented.	3
SECTION D		
	Q.no 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.	
2 9	STDs constitute a major public health problem for both developing and developed countries. The emergence of HIV infection has increased the importance of measures aimed at control of STDs. A proper understanding of the patterns of STDs prevailing in different geographic regions of a country is necessary for proper planning and	4

implementation of STD control strategies. It is with this aim that the authors have reviewed the relevant published literature from India over the past 25 years. To sum up, bacterial STDs like chancroid and Gonorrhoea are showing a declining trend, but the viral STDs like herpes genitalis and condylomata acuminata are showing upward trend. There is a decline in the number of patients with STDs attending the hospital. Whether this is due to an actual decrease in the incidence of STDs or due to other factors is uncertain. The increased availability of facilities for treatment of STDs at peripheral centres might be a factor leading to a decline in the number of patients with STDs approaching higher centres like the teaching hospital where this study was undertaken. The emphasis on the syndromic approach to the management of STDs might have increased the accessibility to healthcare for these patients with STDs. Awareness about HIV and fear of STDs are factors of reducing infection with STDs. Another factor to be considered is the widespread use of antibacterials, including quinolones and the new macrolides, for the treatment of other diseases. This can result in partial treatment or modified course of the bacterial STDs, thereby leading to apparent reduction in the total number of cases of STDs

attending STD clinics as well as a decrease in the proportion of bacterial to viral STDs.

(i) Which of the following is not a bacterial STD?

- a) Syphilis b) Gonorrhoea c) Herpes genitalis d) Chlamydia

(ii) Choose the odd one out:

- a) Genital herpes b) Genital warts c) Trichomoniasis d) Hepatitis B

(iii) Which of the following symptoms is not seen in case of an STD?

- a) Slight pain in genitals
- b) Swelling in the genitals
- c) Itching and fluid discharge from the genitals
- d) Redness/discoloration in the genitals

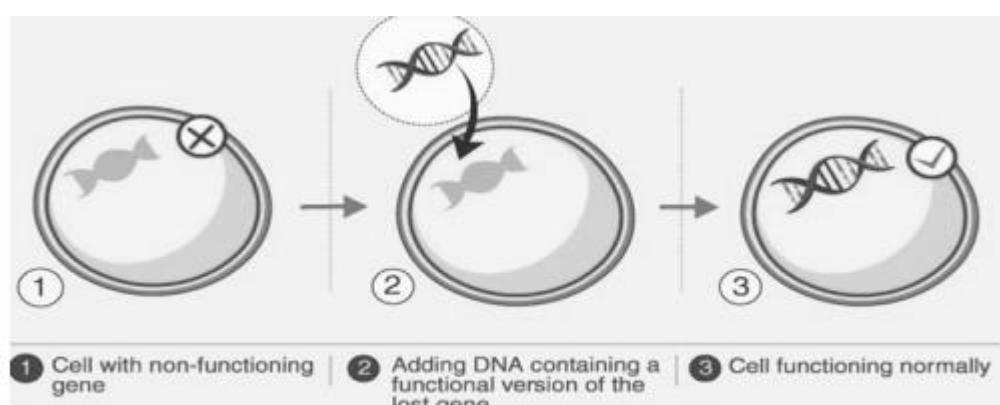
(iv) Which of the following is not a complication which arises when STDs are not treated on time?

- a) PID
- b) Infertility
- c) Cancer of the rectum
- d) Still births

OR

(iv) Which contraceptive method is effective against STDs.

3
0



4

i) Identify the process depicted in the above diagram.

- a) DNA Extraction
- b) Cloning

	<p>c) Gene Therapy d) Sequencing</p> <p>ii) Which enzyme is crucial for the immune system to function? a) ZDA b) YDA c) AAD d) ADA</p> <p>iii) What are the other methods for the treatment of ADA Deficiency? a) Bone Marrow Transplantation b) Enzyme Replacement Therapy c) Both A and B d) Medicines</p> <p>iv) In gene therapy, the gene defects are cured in a child or in _____ stage. OR iv) Name the vector used to introduce a functional ADA cDNA into the patient's lymphocytes.</p>																																																													
	SECTION E																																																													
3 1	<p>What is an operon? Describe the major steps involved in an operon?</p> <p>OR</p> <p>a) Who performed the blander experiment? b) What does this experiment prove? c) Describe the steps followed in this experiment?</p>	5																																																												
3 2	<p>Differentiate between dominance, co-dominance & Incomplete dominance with one example each.</p> <p>OR</p> <p>In dogs, barking trait is dominant over silent trait & erect ears are dominant over drooping ears. What is the expected phenotypic ratio of offspring when dogs heterozygous for both the traits are crossed?</p>	5																																																												
3	<p>The graph illustrates the fluctuation of three hormones over a 28-day period. The Y-axis represents hormone concentration, and the X-axis represents days. Progesterone (light grey line) shows a single prominent peak at day 14. Estrogen (medium grey line) exhibits two peaks: a smaller one around day 10 and a larger one around day 22. Testosterone (dark grey line) shows a single peak around day 22.</p> <table border="1"> <thead> <tr> <th>Days</th> <th>Progesterone</th> <th>Estrogen</th> <th>Testosterone</th> </tr> </thead> <tbody> <tr><td>2</td><td>Low</td><td>Very Low</td><td>Very Low</td></tr> <tr><td>4</td><td>Low</td><td>Very Low</td><td>Very Low</td></tr> <tr><td>6</td><td>Low</td><td>Very Low</td><td>Very Low</td></tr> <tr><td>8</td><td>Low</td><td>Medium</td><td>Very Low</td></tr> <tr><td>10</td><td>Very Low</td><td>High</td><td>Very Low</td></tr> <tr><td>12</td><td>Very Low</td><td>Medium</td><td>Very Low</td></tr> <tr><td>14</td><td>Peak</td><td>Medium</td><td>Very Low</td></tr> <tr><td>16</td><td>Very Low</td><td>Very Low</td><td>Very Low</td></tr> <tr><td>18</td><td>Very Low</td><td>Very Low</td><td>Very Low</td></tr> <tr><td>20</td><td>Very Low</td><td>Medium</td><td>Very Low</td></tr> <tr><td>22</td><td>Very Low</td><td>High</td><td>Peak</td></tr> <tr><td>24</td><td>Very Low</td><td>Medium</td><td>Medium</td></tr> <tr><td>26</td><td>Very Low</td><td>Very Low</td><td>Medium</td></tr> <tr><td>28</td><td>Very Low</td><td>Very Low</td><td>Medium</td></tr> </tbody> </table> <p>a) Read the graph given above and correlate the uterine events that take place according to the hormone levels on</p>	Days	Progesterone	Estrogen	Testosterone	2	Low	Very Low	Very Low	4	Low	Very Low	Very Low	6	Low	Very Low	Very Low	8	Low	Medium	Very Low	10	Very Low	High	Very Low	12	Very Low	Medium	Very Low	14	Peak	Medium	Very Low	16	Very Low	Very Low	Very Low	18	Very Low	Very Low	Very Low	20	Very Low	Medium	Very Low	22	Very Low	High	Peak	24	Very Low	Medium	Medium	26	Very Low	Very Low	Medium	28	Very Low	Very Low	Medium	5
Days	Progesterone	Estrogen	Testosterone																																																											
2	Low	Very Low	Very Low																																																											
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6	Low	Very Low	Very Low																																																											
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26	Very Low	Very Low	Medium																																																											
28	Very Low	Very Low	Medium																																																											

- (i) 6-15 days
 (ii) 16-25 days
 (iii) 26-28 days (if the ovum is not fertilized)
- b)
 (i) At what stage is oogenesis initiated in human female?
 (ii) When does the oocyte complete oogenesis?

OR

- a) Draw a neat diagram of the female reproductive system and label the parts associated with the following.
- Production of gamete
 - Site of fertilization
 - Site of implantation
 - Birth canal
- b) Write any four differences between spermatogenesis and oogenesis.



مَدْرَسَةُ دَلْهِيِّ الْخَاصَّةُ ذ.م.م.
DELHI PRIVATE SCHOOL L.L.C.
 Affiliated to C.B.S.E., DELHI

ANSWER KEY Pre Board Examination 2022-23

Subject: Biology

Grade: XII

Max. Marks:70

Time: 3 hrs

General Instructions: -

- (vi) All questions are compulsory.
- (vii) The question paper has five sections and 33 questions. All questions are compulsory.
- (viii) Section-A has 16 questions of 1 mark each; Section-B has 5 questions of 2 marks each; Section-C has 7 questions of 3 marks each; Section-D has 2 case-based questions of 4 marks each; and Section-E has 3 questions of 5 marks each.
- (ix) There is no overall choice. However, internal choices have been provided in some questions.
A student has to attempt only one of the alternatives in such questions.
- (x) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION A

1	c	1
---	---	---

2	d	1
3	c	1
4	c	1
5	c	1
6	b	1
7	d	1
8	b	1
9	a	1
10	a	1
11	a	1
12	c	1
13	a	1
14	b	1
15	c	1
16	d	1

SECTION B

17	a. Human and Drosophilla b. <i>Pisum sativum</i>	$\frac{1}{2}+1/2$ 1	2
18	S.No	Perisperm	Pericarp
	1	It represents the persistent remains of nucellus in the seed	It represents the wall of the fruit formed by ovarian wall
	2	It is usually dry	It can be dry or fleshy
			$1+1$
19	Aims of RCH programme are: (i) To create awareness about various reproduction-related aspects. (ii) To prevent and control STDs. (iii) To educate fertile couples about birth control measures. (iv) To provide medical facilities to decrease MMR and IMR. (v) Pre-natal and post-natal care of mother and child.	Any 4 points $\frac{1}{2}*4$	2
20	(i) Rete testis : (ii) Vasa efferentia : (iii) Epididymis : (iv) Vasa deferentia :	Storage of sperms produced by seminiferous tubules. Conduct the sperms from rete testis to epididymis. Storage, nutrition to and physiological maturation of sperms. Conduct the sperms from epididymis to urethra.	2
21	The integration of natural science and organisms, cells, parts thereof and molecular analogies for products and services is called biotechnology. Two principles are: (i) Genetic Engineering (ii) To maintain the microbial contamination free (sterile) ambience; in chemical engineering.	$1+1/2+1/2$	2

	OR (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) -1.5 marks Explanation-1.5 marks																								
	SECTION C																								
2 2	(a) UAC (b) AUG (c) Aminoacyl tRNA synthetase. 1+1+1	3																							
2 3	(i) Green pod colour is dominant (ii) Green pod colour (iii) <table style="margin-left: auto; margin-right: auto;"> <tr> <td>Parents</td> <td>GG(green)</td> <td>X</td> <td>gg (yellow)</td> </tr> <tr> <td>Gametes</td> <td>(G)</td> <td></td> <td>(g)</td> </tr> <tr> <td>F1 generation</td> <td></td> <td>Gg (Hybrid green)</td> <td></td> </tr> <tr> <td>Gametes</td> <td>(G)</td> <td>(g)</td> <td>X</td> <td>(G)</td> <td>(g)</td> </tr> <tr> <td>F2 generation</td> <td>GG</td> <td>Gg</td> <td>Gg</td> <td>gg</td> </tr> </table> Phenotypic ratio 3 : 1 Genotypic ratio 1 : 2 : 1	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	1/2+1/2+2
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																					
2 4	(i) Have origin of replication(Ori) (ii) Have a selectable marker (iii) Have at least one recognition site.	3 1+1+1																							
2 5	(a) Cleistogamous flowers remain closed with anthers and stigma lying close to each other. When the anthers dehisce the pollen grains come in contact with stigma, pollination takes place. Thus, cleistogamy leads to self-pollination making cleistogamous flowers invariably autogamous. (b) Geitonogamy is transfer of pollen grains from anthers of one flower to stigma of another flower of either the same or genetically similar plant. It resembles cross-pollination as it needs a pollinating agency for transfer of pollen grains. Thus, geitonogamy is functionally cross-pollination but genetically like autogamy. c) In many flowers, pollen release and stigma receptivity are not synchronized. Either the pollen is released much before the maturity of stigma or stigma matures much before the release of pollen. In some flowers, anthers and stigma are placed at different places so that pollen grains from the same flower cannot reach the stigma. Some flowers follow self-incompatibility between pollen and stigma. This is a genetically mediated process which prevents autogamy in these flowers.	3 1+1+1/2+1/2																							
2 6	Three cells at micropylar end of embryo sac constitute egg apparatus. It is made up of two cells synergids or help cells and an egg or oosphere which hangs between them. Triple fusion is the fusion of second male gamete with two haploid polar nuclei or diploid secondary nucleus of central cell to form triploid primary endosperm nucleus (PEN).	3 1.5+1.5																							

OR

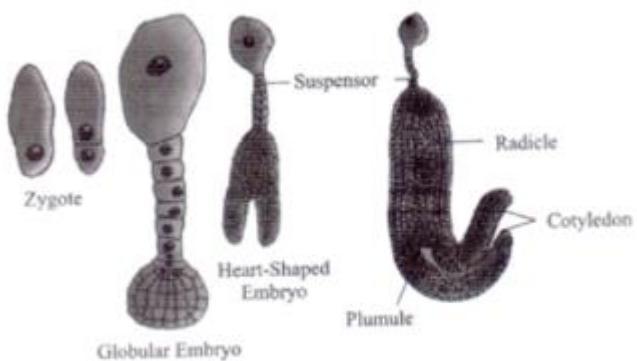
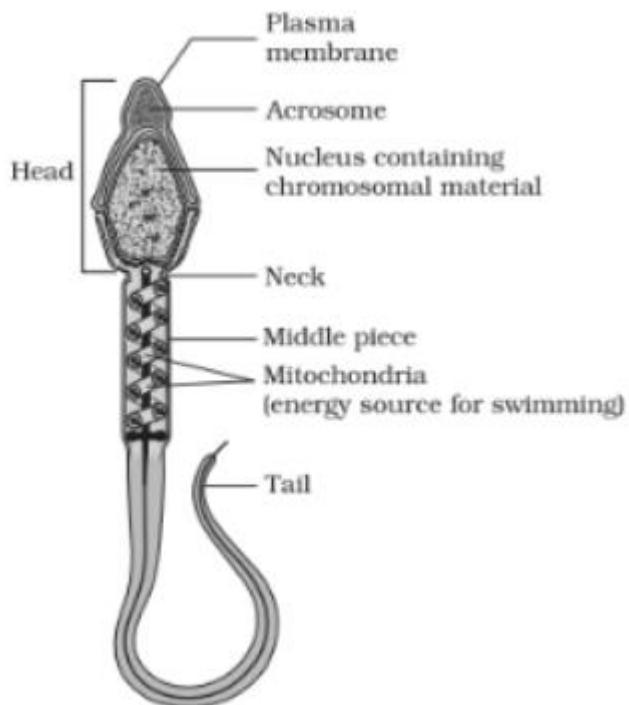


Figure: The different stages of embryo development in a dicot.

Diagram-1.5
Labelling-1.5(any 3)

2
7



3

Diagram-1,Any 4 labels-2 marks

2
8

- (i) Mechanical methods like :
 - (a) Use of condoms by male before starting copulation.
 - (b) Diaphragms and cervical caps fitted in vagina of female.
 - (c) Intrauterine devices like copper-T and loops.
- (ii) Chemical methods like :
 - (a) Use of spermicidal jellies, pastes, etc. in the vagina of female before copulation.
 - (b) Use of birth control pills containing synthetic progestins and estrogens.
- (iii) Surgical methods like :
 - (a) Male sterilization by **castration** (removal of testes) or **vasectomy**.
 - (b) Female sterilization by **ovariectomy**, **tubectomy** and **tubal ligation**.

3

1+1+1

SECTION D

	Q.no 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.	
2 9	i-c ii-c iii-d iv-c OR Barrier method/condoms/diaphragms(any one)	4
3 0	i-c ii-d iii-c iv-Embryonic OR Retroviral vector	4
SECTION E		
3 1	Operon is a group of controller & structural genes which controls the catabolism of the cell genetically eg lactose operon/lac operon.	5
	<p>i. When inducer or lactose is absent:- The lac regulator gene synthesizes a repressor protein by transcription & translation. This repressor protein binds with operator site of lac operon & blocks RNA polymerase. Thus, RNA polymerase unable to transcribe mRNA & structural gene unable to translate enzyme β-galactosidase.</p> <p>ii. When inducer or lactose is present:- The lac regulator gene transcribes mRNA & synthesizes active lac repressor protein & at the same time lactose is converted into isomer allolactose. Allolactose binds to active lac repressor due to which it is converted to inactive repressor. This inactive repressor is released from operator site of lac operon & RNA polymerase binds to promoter & starts to transcribe mRNA & forms β-galactosidase which converts lactose into glucose & galactose.</p>	
	Thus, presence of lactose determines whether or not lac. Repressor is bound to operator & genes are expressed or not.	
	<p>The diagram illustrates the lac operon structure and its regulation. The operon consists of a promoter (P), an operator (labeled 'o' with a circle), and structural genes (z, y, a). In the absence of an inducer, the repressor mRNA is transcribed and translated into a repressor protein. This protein binds to the operator region, preventing RNA polymerase from binding to the promoter and transcribing the structural genes. In the presence of an inducer, the inducer binds to the repressor protein, forming an inactive repressor complex. This inactive repressor does not bind to the operator, allowing RNA polymerase to bind to the promoter and transcribing the structural genes into lac mRNA, which is then translated into β-galactosidase, permease, and transacetylase enzymes.</p>	

3+2

OR

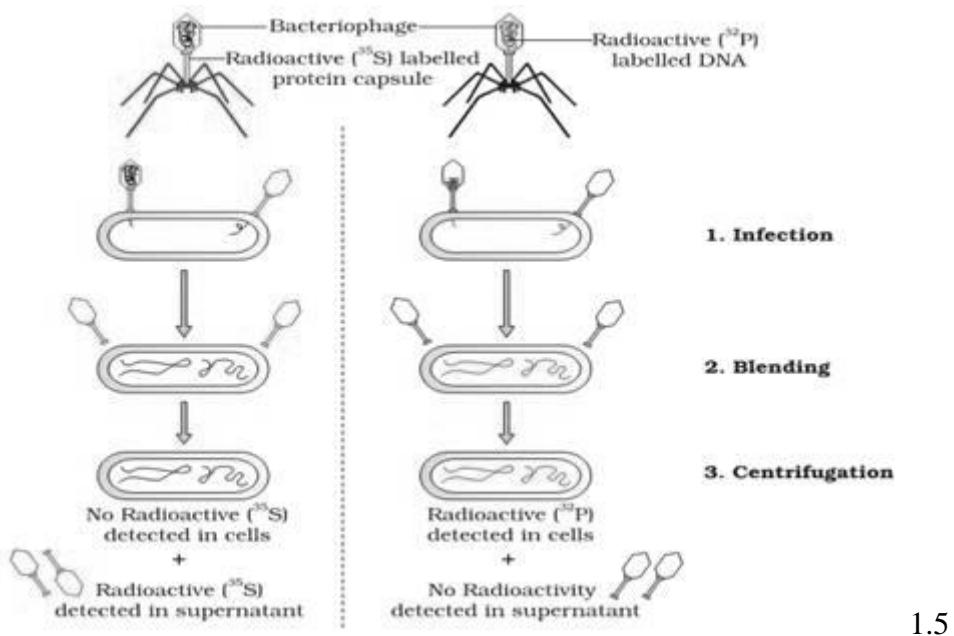
The proof for DNA as the genetic material came from the experiments of Harshey & chase (1) who worked with bacteriophage.

The bacteriophage on infection injects only the DNA into the bacterial cell & not the protein coat.(1)

Bacterial cell treats the viral DNA as its own & subsequently manufactures more virus particles.

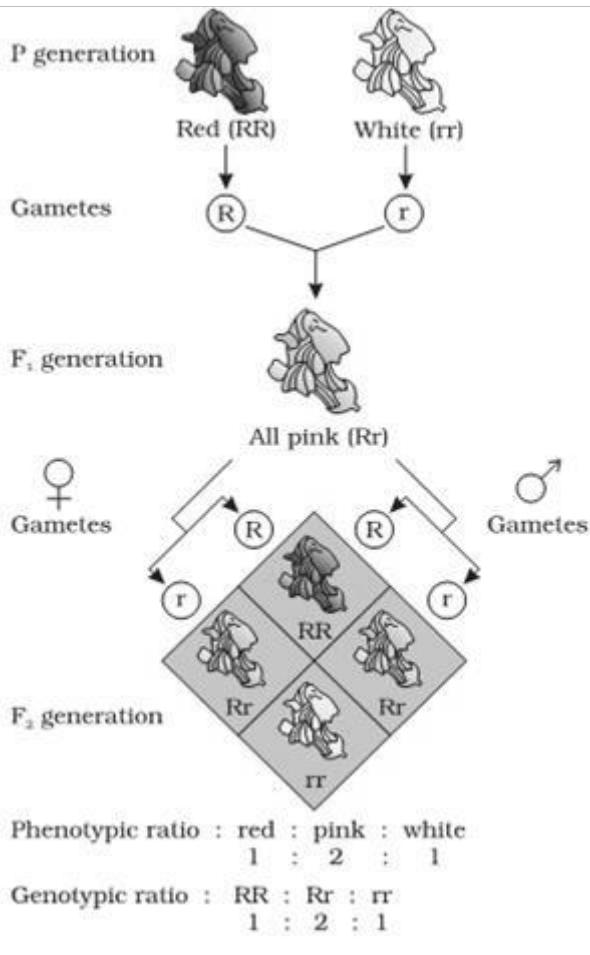
They grew some viruses on a medium that 'contained radioactive Phosphorus & some other on medium that contained radioactive sulphur. Virus grown in the presence of radioactive phosphorus contained radioactive DNA but not proteins because DNA contains phosphorus. Similarly virus grown on radioactive sulfur contained radioactive protein because DNA does not contain sulfur.

Radioactive phages are allowed to infect E. coli bacteria & soon after infection the cultures were gently agitated in a blender to separate the adhering protein coat of virus from bacterial cell. It was found that when phage containing radioactive DNA was used to infect the bacteria its radioactivity was found in bacterial cells indicating that DNA has been injected into bacterial cell so, the DNA is the genetic material & not proteins(1.5)



- 3 2 (i) Dominance :- When a cross is made between true – breeding tall pea plant & true – breeding dwarf pea plant, all the plants in F₁ generation are tall this shows that tall character is dominant over dwarf

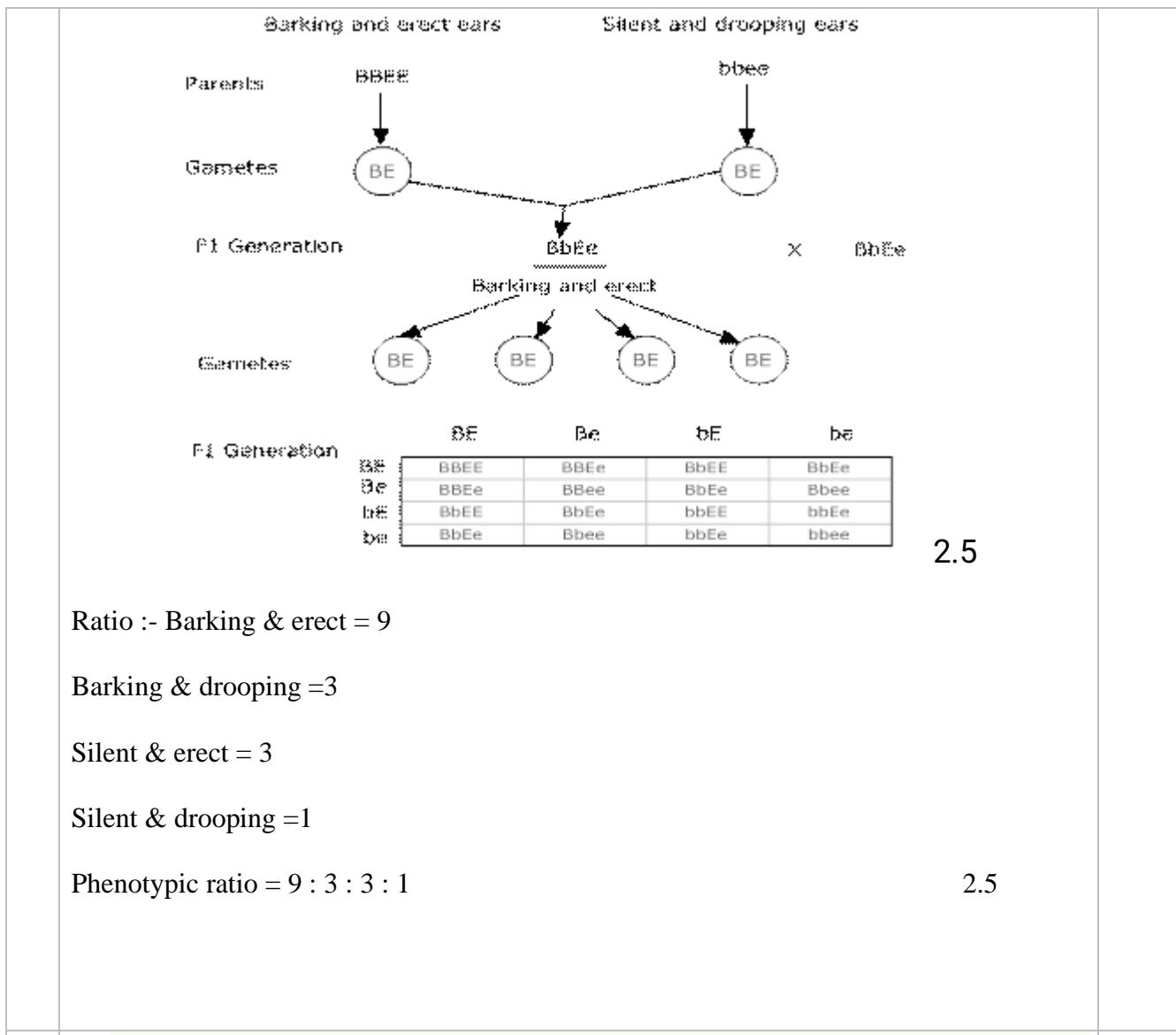
5



(ii) Co-dominance :- If the two equally dominant genes are present together, both of them will be equally expressed, this phenomena is called co-dominance eg alleles of blood group IA & IB are dominant over IO but when both the alleles are present together, both of them will equally express & forms a phenotype AB. 1 mark

(iii) In complete dominance :- When a cross is made between two characters of which none of them is completely dominant then an intermediate character develops in the progeny eg. when a cross is made between red flower & white flower in snapdragon flower an intermediate pink colour appears in the progeny 2 marks

OR



Ratio :- Barking & erect = 9

Barking & drooping = 3

Silent & erect = 3

Silent & drooping = 1

Phenotypic ratio = 9 : 3 : 3 : 1

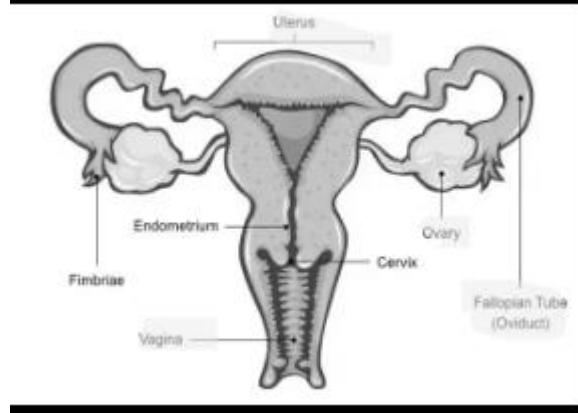
2.5

- 3 a) I-Regeneration of the endometrium,
 3 II--Endometrium thickens, becomes vascularized, ready to receive and implant embryo,
 III- Degeneration of endometrium'. 3 marks
 b) i)In human female oogenesis is initiated during embryonic developmental stage.
 ii) An oocyte completes oogenesis only after the attainment of puberty and during fertilisation. Otherwise suspended at diplotene stage. 2 marks

OR

a)

- i) Production of gametes - Ovary
 ii) Site of fertilization - fallopian tube or oviduct
 iii) Site of implantation - Uterus
 iv) Birth canal – Vagina Diagram-1 mark, Labelling-2 marks



b)

Spermatogenesis	Oogenesis
The production of sperms from spermatogonia is known as spermatogenesis	The production of eggs from oogonia is known as oogenesis
Occurs in testes	Occurs inside the ovary
All stages are completed in testes	The major part of oogenesis occurs inside the ovary. The last few stages occur in the oviduct.
It is a continuous process	It is a discontinuous process. The early stages take place in the foetus and the rest in later stages of life.
Produces motile gametes	Produces non-motile gametes
Equal cytokinesis occurs during the spermatogenesis producing four sperms	Unequal cytokinesis occurs during oogenesis ultimately producing one large ovum and tiny polar bodies

Any 4 difference-2 marks

PRACTICALS

Practicals 60 Periods

A. List of Experiments

1. Prepare a temporary mount to observe pollen germination.
2. Study the plant population density by quadrat method.
3. Study the plant population frequency by quadrat method.
4. Prepare a temporary mount of onion root tip to study mitosis.
5. Isolate DNA from available plant material such as spinach, green pea seeds, papaya, etc.

B. Study/observation of the following (Spotting)

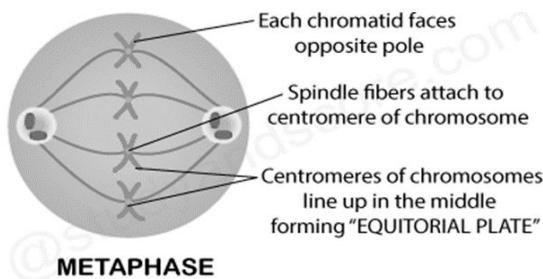
1. Flowers adapted to pollination by different agencies (wind, insects, birds).
2. Pollen germination on stigma through a permanent slide or scanning electron micrograph.
3. Identification of stages of gamete development, i.e., T.S. of testis and T.S. of ovary through permanent slides (from grasshopper/mice).
4. Meiosis in onion bud cell or grasshopper testis through permanent slides.
5. T.S. of blastula through permanent slides (Mammalian).
6. Mendelian inheritance using seeds of different colour/sizes of any plant.
7. Prepared pedigree charts of any one of the genetic traits such as rolling of tongue, blood groups, ear lobes, widow's peak and colour blindness.
8. Controlled pollination - emasculation, tagging and bagging.
9. Common disease causing organisms like Ascaris, Entamoeba, Plasmodium, any fungus causing ringworm through permanent slides, models or virtual images or specimens. Comment on symptoms of diseases that they cause.
10. Models specimen showing symbiotic association in root modules of leguminous plants, Cuscuta on host, lichens.
11. Flash cards models showing examples of homologous and analogous organs.

Exp 4: ONION ROOT TIP SLIDE

AIM: To prepare a temporary mount of onion root tip slide to show any one of the phases (metaphase or anaphase)

Metaphase:

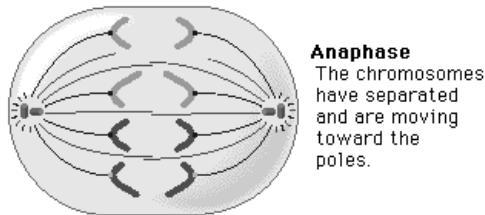
- i. A bipolar, spindle develops in the cell. Chromosomes become thick and two chromatids of each chromosome become clear.
- ii. Chromosomes become arranged at the equator of the spindle.
- iii. Each chromosome gets attached to the spindle fibers at its center.



Observation: The given slide preparation shows *Metaphase* of mitosis of a root tip.

Anaphase:

- i. Centromere splits and the two sister chromatids of each chromosome separate from the centromere and move towards the opposite poles. Separated chromatids are called as daughter chromosomes.
- ii. The daughter chromosomes (separated chromatids) appear V, J, L and I shape depending upon the position of centromere.



Observation: The given slide preparation shows *Anaphase* of mitosis of a root tip.

Precautions

- Overstaining and understaining should be avoided
- There should not be any air bubble under the coverslip
- Slide should be warmed gently much above the flame.
- Root tip should not be overheated
- Gently squash the root by tapping the coverslip

SPOTTERS

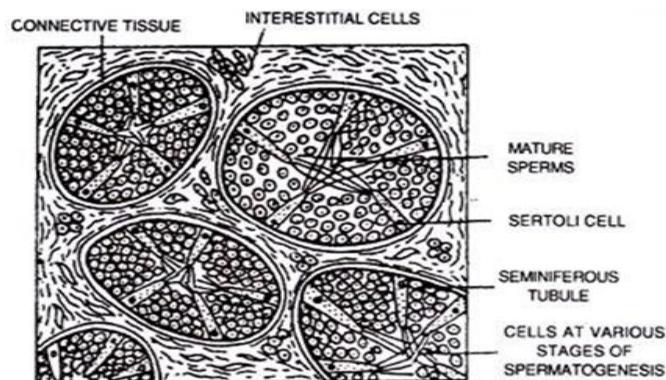
I. IDENTIFY THE STAGES OF GAMETE DEVELOPMENT THROUGH PERMANENT SLIDE:

- a) The given slide shows spermatogenesis of the Transverse Section of a mammalian testis during gametogenesis.

i. The mammalian testis is covered by thick fibrous tissue called tunica albuginea. The testis consists of numerous seminiferous tubules embedded in the interstitial tissue. Various types of germinal cells are present outside towards lumen in the following sequence:

Spermatogonia → spermatocytes → spermatids → spermatozoa → sperms

ii. Between the germinal cells pyramid shaped cells called sertoli cells are present. A large number of spermatozoa with their heads embedded in sertoli cells are present in the lumen of seminiferous tubule. The interstitial tissue also contains leydigs, which produce male sex hormone testosterone.



- b) The given slide shows vertical section of a mammalian ovary showing oogenesis
- A mammalian ovary is a solid structure bounded by germinal epithelium followed by a thick layer of fibrous tissue, the tunica albuginea.
 - The ovary consists of outer cortex and inner medulla. The medulla contains many rounded or oval bodies called ovarian or graafian follicles at various stages of development. The medulla also contains blood vessels, nerves fibres and some smooth muscles.

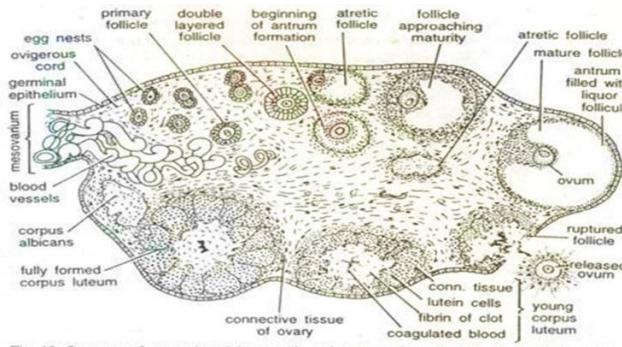
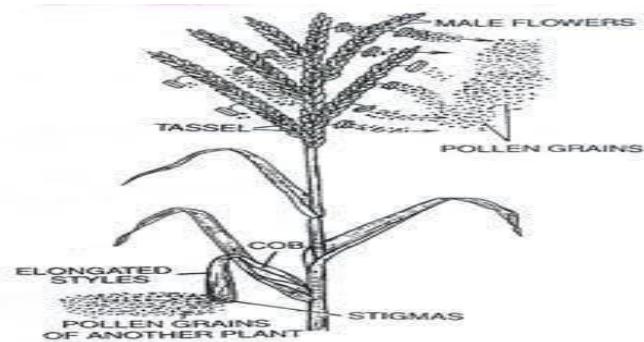


Fig. 10. Sequence of events in origin, growth, and rupture of ovarian (Graafian) follicle and in formation and retrogression of corpus luteum in mammalian ovary.

II. POLLINATING AGENTS:

- a) **THE GIVEN SPOT IS POLLINATING AGENT OF MAIZE FLOWER WHICH IS WIND (ANEMOPHILLY)**



- The maize plant produces unisexual, small and inconspicuous flowers above the foliage or in a hanging position with both the stigmas and the anthers are exerted and hang outside the perianth.
- Anthers are versatile and pollen grains are light, small, dusty and produced in large numbers. Stigma is hairy, feathery or branched to catch wind born pollen grains.

- b) **THE GIVEN SPOT IS POLLINATING AGENT OF SALVIA FLOWERS WHICH IS INSECT (ENTAMOPHILLY)**

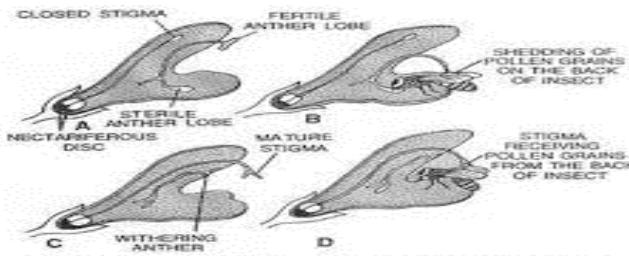


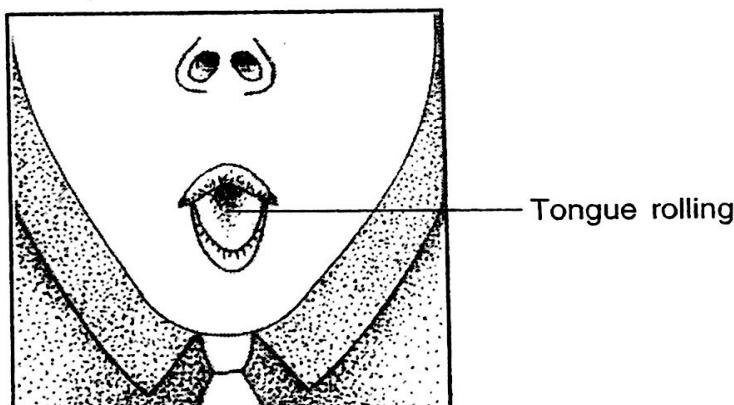
Fig. 2.22. Pollination in *Salvia*. A, flower with mature anthers, closed stigma and short style. B, shedding of pollen grains on the back of entering insect. C, flower with mature stigma and withering anthers. D, stigma receiving pollen grains from the back of entering insect.

- i. The flowers are showy or brightly colored for attracting pollinating insects. They are born in verticillate inflorescence to become conspicuous. The flowers have nectar glands which are placed in such a position that an insect must touch both the anthers and stigmas.
- ii. The flowers have landing platforms for the insects. They are protandrous with bilipped corolla and have turn pipe or lever mechanism.
- iii. Each stamen has long connective which bears a fertile anther lobe at the lower end. The two sterile anther plates block the path of the insect. As the insect moves inward a young flower in search of nectar, its head pushes, the anther plates and forces the fertile anther lobes to strike against its back

III: GENETIC TRAITS:

a) TONGUE ROLLING

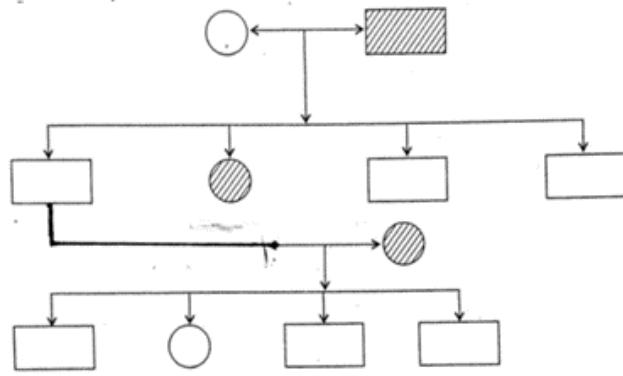
- i. Tongue rolling is a genetic trait in which persons with a dominant allele in heterozygous or homozygous condition can roll their tongues into tube-like shape as shown in chart.



Tongue rolling

- ii. Homozygous recessive persons are non-rollers and can never learn to roll their tongues.
- iii. Inheritance of tongue rolling is not related to sex.
- iv. Male parent as tongue roller is heterozygous. (R,r)

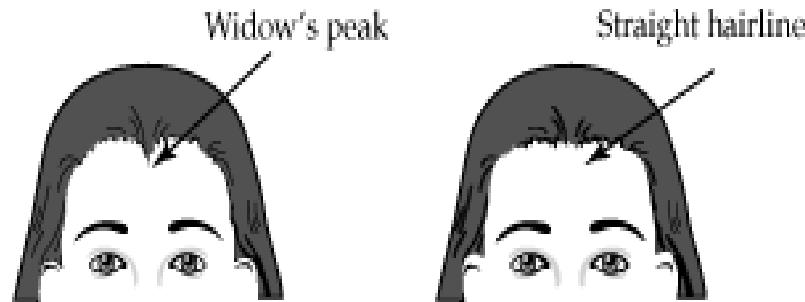
v. Female parent is non-roller(r,r)

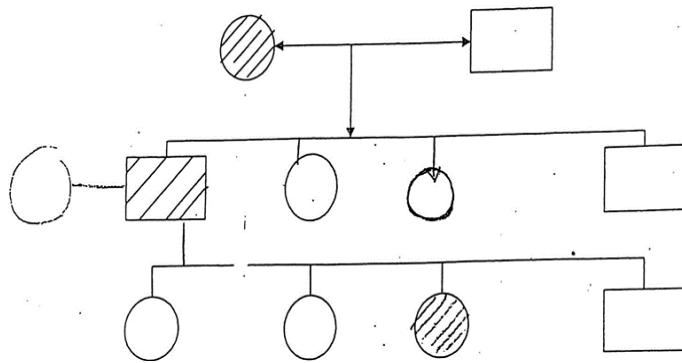


Pedigree chart for rolling tongue

b) The given spot shows genetic trait as widows peak.

i. The widows peak is the genetic trait in which dominant allele in heterozygous or homozygous individuals result in V-shaped front hair line as shown in figure.
Homozygous recessive individuals have straight hair lines.





Pedigree chart for widows peak

- ii. Widows peak hair line is not related to sex.
- iii. Female parent with widow peak hair line is heterozygous (W,w)
- iv. Male parent is with straight hair line trait is homozygous. (w,w)

IV.DISEASES & CASUAL ORGANISM

a) The given specimen shows an ascaris (round worm)

Disease caused: Ascariasis

Comments:

- i. It is an endoparasite of human beings and is more common in children.
- ii. The female worm is longer than the male.
- iii. The posterior end of the male is curved ventrally.
- iv. In female, the genital aperture is present on the mid-ventral line at about one third of the length from the anterior end.
- v. In male from the cloaca two equal chitinous spicules or pineal setae project which help in copulation.

Symptoms

- vi. It obstructs the intestinal passage and cause abdominal discomfort like colic pains
- vii. Patient may suffer from impaired digestion, diarrhoea and vomiting
- viii. In children mental efficiency is affected and body growth is affected

V.ADAPTATION

a) The given specimen shows xerophytic adaptation of *Opuntia dillenii (nagphani)*

Comments:

- i. It is succulent or drought resisting xerophyte
- ii. The leaves are caduceus. They fall down soon after their formation to reduce transpiration.
- iii. The stem is jointed, flattened and green called phylloclades. It takes over the function of photosynthesis.
- iv. The stem becomes fleshy due to the storage of water.
- v. Phylloclades bear several nodes or areoles which have one or more spines which represent the leaves of axillary branches.
- vi. There are a number of bristles to reduce transpiration.

b) The given specimen shows xerophytic adaptation of KANGAROO RAT

- i. It is xerocoels rodent, which avoid heat by adopting nocturnal habits.
- ii. It conserves water by excreting solid urine and can live from birth to death without drinking water.
- iii. It seals its burrow by day to keep its chamber moist.
- iv. It obtains water from its own metabolic processes and from hygroscopic water in its food.

c) The given specimen shows hydrophytic adaptation of Hydrilla

- i. It is a submerged hydrophyte found attached to the substratum by adventitious roots in freshwater ponds.
- ii. The stem is soft and slender and bears thin and membranous leaves in whorls of 3-8
- iii. The leaves are arranged in such a way to provide least resistance to the flow of water. They lack cuticle and stomata.
- iv. The whole plant is covered over by mucilage. It prevents epiphytic growth and protects and plant against the rotting effect of water.

d) The given specimen shows Aquatic adaptation of Rohu

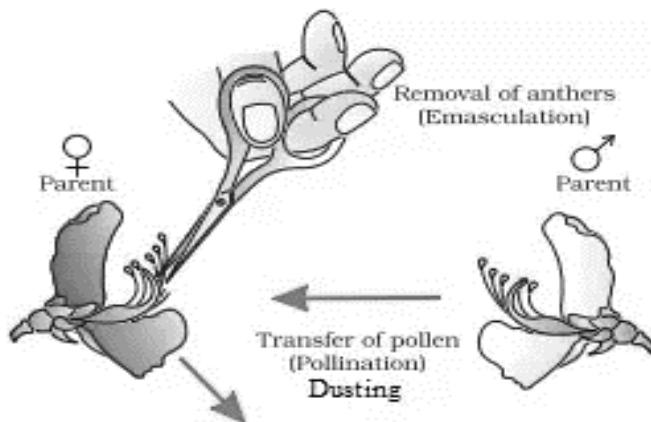
- i. Its body is compressed laterally to reduce friction and to allow swift passage in water while swimming.
- ii. It possesses fins that help in swimming.
- iii. It has air bladder or swim bladder which maintains buoyancy.
- iv. It possesses gills as organs of respiration for the exchange of gases in water
- v. The body is covered with water impermeable scales to prevent osmotic entry of water in the body

VI. The given experimental set up shows controlled pollination which include emasculation, bagging, tagging and labelling.

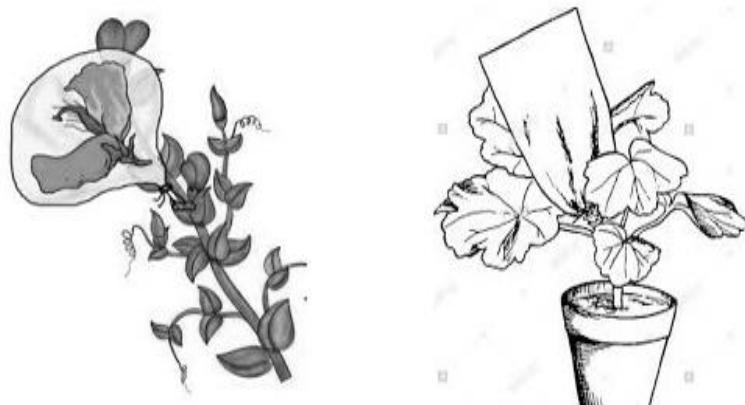
Hybridization is a method by which improved varieties of economically important plants/crops are produced by crossing two or more genetically different plants.

Emasculation

- Anthers are removed from the large flowers before their maturation.
- The anthers are cut with the help of sterilized forceps or scissors.
- In crops having small flowers like paddy the pedicles are dipped in hot water (40-45°C for 1-10 mts to kill the anthers) It can be done the same way with cold water or alcohol.



Bagging, tagging and labeling.



- After emasculation the flowers are covered with small bags to prevent pollination with undesired pollen grains.

- b) These bags are made of polythene, paper, muslin cloth or parchment paper.
- c) The bags are punctured or made perforated so as to provide aeration to the flowers.
- d) The flowers of male parents are also protected in bags to prevent mixing of their pollen grain with foreign pollens.
- e) After dusting of the desired pollen grains on the emasculated flowers the bags are retagged.
- f) A label of papers is tagged on the plant which displays the date of emasculation, crossing and brief account of the parents.

DNA EXTRACTION FROM STRAWBERRIES

Materials for one extraction:

- Zip lock plastic bag
- 1 strawberry (fresh or defrosted)
- 10mL DNA extraction buffer
- Gauze, cut into squares
- Funnel
- Ice cold ethanol
- Plastic transfer pipette
- Clear test tube, plastic/glass
- Long wooden skewer



DNA extraction buffer:

Makes 50mL (enough for 5 extractions)

- 5 mL liquid dish washing detergent or shampoo
- 0.75g salt
- 45mL water

- **To make:** Measure detergent and water in a measuring cylinder, weigh out the salt and combine ingredients into a labelled bottle or beaker

What to do:

Make the DNA extraction buffer following the method above:

- Wash the strawberry, remove the sepals (the green leaves) and put it into a zip lock plastic bag. Add 10mL of the extraction buffer and seal the bag tightly, making sure any air bubbles are pushed out and crush the strawberries with your fingers on the bench surface for 1 minute.

Note: Do not crush the strawberries too much as this will cause the DNA to shear/ degrade

What is happening?

- Crushing the strawberries breaks open many of the strawberry cells, releasing the nuclei where the DNA is.
- The soap in the detergent or shampoo in the extraction buffer breaks down the fatty membranes of the cells, breaks open the nuclear membrane and releases the DNA into solution.
- The salt makes the DNA molecules stick together, and separate from the proteins that are also released from the cells



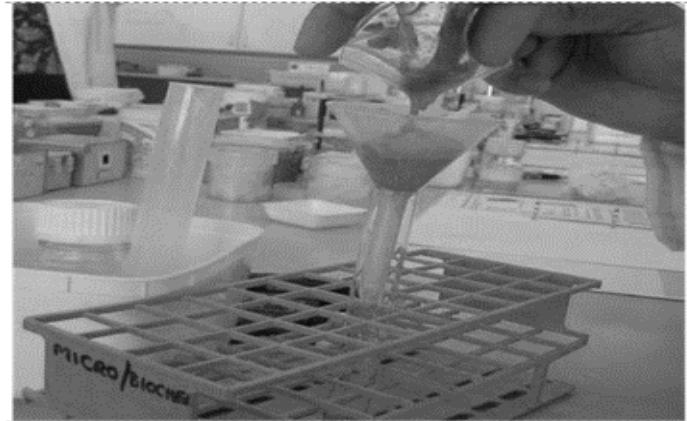
3. Place the funnel lined with gauze into the test tube.

4. Pour the strawberry DNA extraction buffer mixture into the gauze and filter the mixture into the tube through the gauze.

5. Keep the liquid filtered into the tube in the tube and discard the gauze and the strawberry pulp. Layer an equal volume of ice-cold ethanol on top of the strawberry solution in the test tube using the plastic transfer pipette provided.

What is happening?

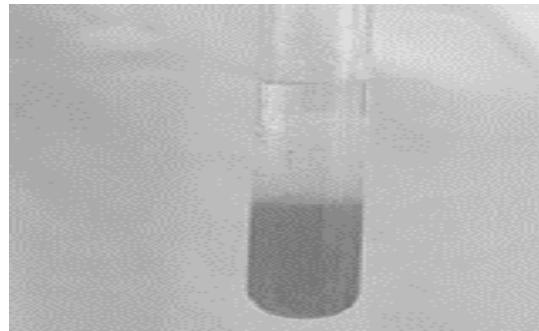
- The gauze retains strawberry cell debris. The strawberry DNA is dissolved in the DNA extraction buffer, which will pass through the gauze into the test tube.



6. Observe what happens at the interface of the alcohol and strawberry solution when you twirl a long wooden skewer through the interface. Keep the tube still at eye level and do not shake it.

What are you seeing?

- The DNA collects between the layer of alcohol on top and strawberry extract underneath!
- DNA is insoluble in alcohol, so it precipitates. What you see is the precipitation of strawberry DNA - long, thread-like DNA molecules at the interface of the alcohol and DNA solution.

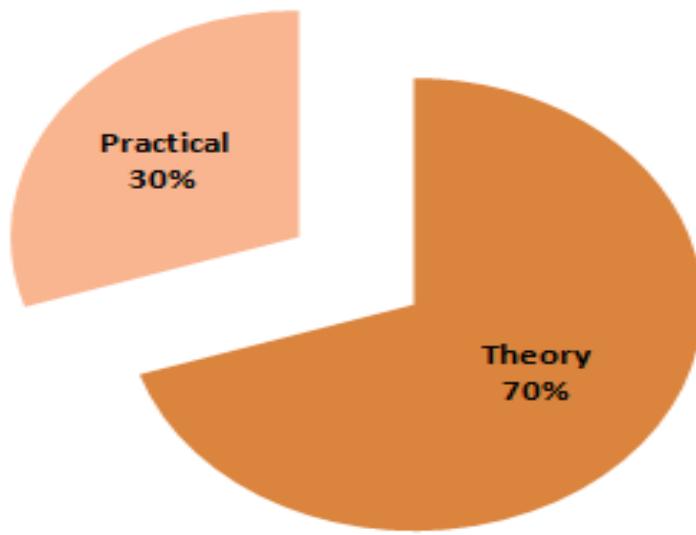


8. You can collect the DNA strands onto a wooden skewer. The whitish, gooey, stringy stuff is DNA containing strawberry genes! This contains the code for all of the proteins required by the strawberry throughout its life.



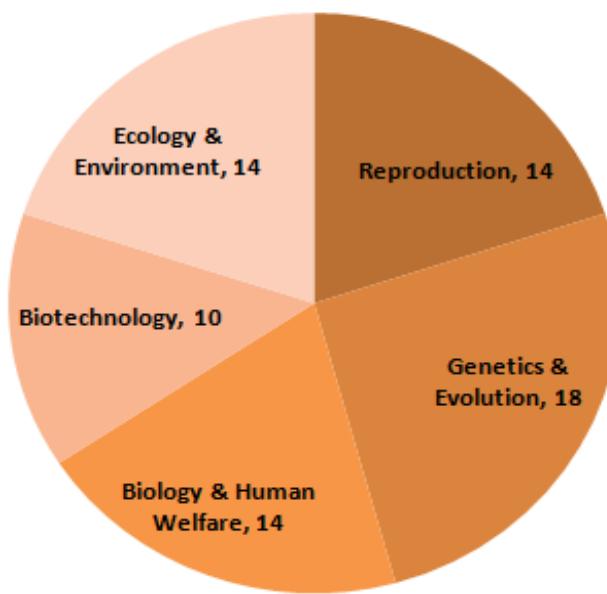
Marks Distribution of Biology Paper for Class 12 Board Exam

Total Marks 100



Weightage to Subject Units Based on CBSE

Total Marks: 70 Marks:

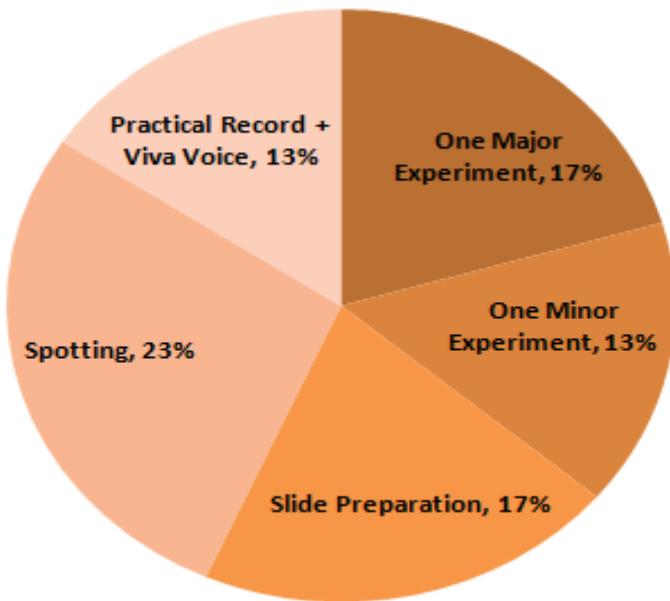


- Weightage to Form of Questions**

Form of Questions	Marks for each Question	No. of Questions	Total Marks
Long Answer Type (LA)	5	3	15
Short Answer (SA I) 3 09 27	3	9	27
Short Answer (SA II) 2 10 20	2	10	20
Very Short Answer (MCQ)	1	8	8
TOTAL		30	70

**CBSE Class 12th Board Exam Paper Pattern for Biology
(Practical's)**

Total Marks: 30 marks



CBSE study tips to score above 90%

Regular studies and completing your syllabus on time wins you half the game. Complete your projects, assignments and practical on the day they are assigned and get them out of your way.

- Start with easier chapters and gradually proceed to topics that you find more difficult. With basics brushed up, you will find that even the most difficult topics will melt down to simpler easier concepts.
 - Solve at least 5 to 10 questions daily without failure.
 - At least three months before the exam, your focus should shift to revision of chapters you already know, solving past year question papers and getting your doubts cleared.
 - Many CBSE board exam questions are directly picked up from NCERT books. So, read them carefully.
 - You must practice diagrams. Flowcharts and cycles can be a good way to learn lengthy processes that might otherwise seem too difficult to learn.
 - On the day of exam, do not worry about the chapters you have not covered well. Most chapters do not carry more than 4 to 5 marks in the [CBSE question paper](#). So, you will still be equipped with more than ammunition to hit off those scores!
-



SUCCESS
is dependent on effort.

~ Sophocles

All THE BEST

**"Connecting Minds,
Creating the Future".**