UP Board 12 Biology (348(GJ)) Question Paper with Solutions

Time Allowed :3 hours	**Maximum Marks :**70	**Total questions :**33

General Instructions

Read the following instructions very carefully and strictly follow them:

1. **All questions are compulsory.**
2. **Illustrate your answers with labeled diagrams, wherever necessary.**
3. **Marks allotted to each question are mentioned against it.**

Multiple Choice Type Questions

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1. (a) Which nitrogenous base is not present in DNA?

(A) Thymine

(B) Uracil

(C) Adenine

(D) Guanine

Correct Solution: (B) Uracil

Solution:

Uracil is found in RNA instead of thymine. In DNA, the four nitrogenous bases are adenine (A), thymine (T), cytosine (C), and guanine (G).

Quick Tip

Remember: DNA contains thymine (T), while RNA contains uracil (U) in place of thymine.

(b) How many contrasting characters were included by Mendel in his experiment?

(A) 7

(B) 8

(C) 9

(D) 10

Correct Solution: (A) 7

Solution:

Mendel studied seven contrasting traits in pea plants, including seed shape, seed color, flower color, flower position, pod shape, pod color, and plant height.

Quick Tip

Remember: Mendel studied 7 traits in pea plants, including height, color, and shape of seeds and pods.

(c) Sickle cell anemia is an example of which type of mutation?

(A) Point mutation

(B) Euploidy

(C) Deletion

(D) Translocation

Correct Solution: (A) Point mutation

Solution:

Sickle cell anemia is caused by a point mutation in the beta-globin gene, where a single nucleotide substitution (adenine to thymine) results in the production of abnormal hemoglobin.

Quick Tip

Remember: Sickle cell anemia results from a point mutation, where a single DNA base change alters hemoglobin structure.

(d) Pollen grains are formed in which organ of the flower?

(A) Microsporangium

(B) Gynoecium

(C) Megasporangium

(D) Ovary

Correct Solution: (A) Microsporangium

Solution:

Pollen grains are produced in the microsporangium, which is located inside the anther of the stamen in a flower. The microspore mother cells undergo meiosis to form haploid pollen grains.

Quick Tip

Remember: Pollen grains develop inside the microsporangium, which is part of the stamen.

Very Short Answer Type Questions

2. (a) Which organism is responsible for the spread of malaria disease?

Solution:

Malaria is caused by the *Plasmodium* parasite, which is transmitted to humans through the bite of an infected female *Anopheles* mosquito.

Quick Tip

Remember: Malaria is transmitted by the female *Anopheles* mosquito, which carries the *Plasmodium* parasite.

(b) Write down the full form of PCR.

Solution:

PCR is a widely used technique in molecular biology for amplifying small segments of DNA. It allows researchers to produce millions or billions of copies of a specific DNA sequence in a short period of time, making it invaluable for applications such as genetic research, medical diagnostics, forensic analysis, and biotechnology.

Quick Tip

Remember: PCR stands for Polymerase Chain Reaction and is used for amplifying DNA sequences.

(c) Write down the name of any one transgenic animal.

Solution:

Dolly was the first transgenic sheep produced using somatic cell nuclear transfer (SCNT), demonstrating the feasibility of cloning in mammals.

Quick Tip

Remember: Dolly the sheep was the first cloned transgenic animal using SCNT technology.

(d) Coloured attractive corolla of flower is suitable for which type of pollination?

Solution:

Brightly colored corollas attract insects such as bees and butterflies, which aid in pollination by transferring pollen from one flower to another.

Quick Tip

Remember: Bright-colored flowers attract insects for pollination; this is called entomophily.

(e) What is the term used for green plants in ecosystem terminology?

Solution:

Green plants are called producers because they synthesize their own food through photosynthesis using sunlight, carbon dioxide, and water.

Quick Tip

Remember: Green plants are called producers as they make food through photosynthesis.

Short Answer Type Questions I

3. (a) Define decomposition.

Solution:

Decomposition is the process by which complex organic matter is broken down into simpler substances by decomposers such as bacteria and fungi. Decomposition plays a vital role in nutrient cycling by converting organic matter into inorganic nutrients, making them available for plant uptake.

Quick Tip

Remember: Decomposers like bacteria and fungi break down dead matter to recycle nutrients in the ecosystem.

(b) Write down the names of any two fermented beverages.

Solution:

Two examples of fermented beverages are:

1. Wine
2. Beer

Fermented beverages are produced by microbial fermentation of carbohydrates present in fruits or grains, primarily using yeast.

Quick Tip

Remember: Wine is made from fermented grapes, while beer is made from fermented barley.

(c) Write a note on the test tube baby programme.

Solution:

The test tube baby programme refers to In Vitro Fertilization (IVF), where fertilization occurs outside the female body in a laboratory.In IVF, an egg is fertilized by sperm in a lab, and the resulting embryo is implanted into the woman's uterus. This technique is used to assist couples facing infertility issues.

Quick Tip

Remember: IVF helps infertile couples by fertilizing the egg outside the body and implanting it in the uterus.

(d) Give two differences between homozygous and heterozygous.

Solution:

Homozygous	Heterozygous
Contains identical alleles (AA or aa)	Contains different alleles (Aa)
Results in pure traits	Results in hybrid traits

Quick Tip

Remember: Homozygous means identical alleles; heterozygous means different alleles.

(e) Write two functions of ribosomes.

Solution:

Two important functions of ribosomes are:

1. Synthesis of proteins by translating mRNA sequences.
2. Facilitating the assembly of amino acids into polypeptides.

Ribosomes act as the site of protein synthesis by reading the genetic information carried by mRNA and assembling amino acids in the correct sequence.

Quick Tip

Remember: Ribosomes help in protein synthesis and amino acid assembly, essential for cell function.

Short Answer Type Questions II

4. (a) Write a short note on polyembryony.

Solution:

Polyembryony is the phenomenon of the development of multiple embryos within a single seed. It can occur naturally in certain plant species such as citrus and mango, as well as in some animals like armadillos. Polyembryony can be of three types:

1. **Simple Polyembryony:** Occurs due to the cleavage of the zygote.

2. **Multiple Polyembryony:** Due to the presence of multiple embryo sacs in an ovule.
3. **Adventive Polyembryony:** When embryos arise from somatic cells outside the embryo sac.

Quick Tip

Remember: Polyembryony results in multiple embryos in a single seed; common in citrus fruits.

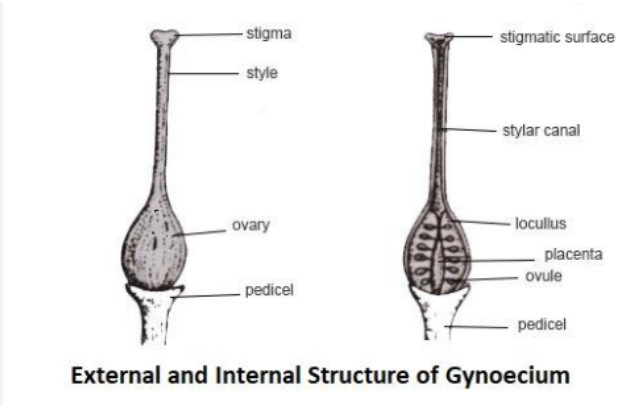
(b) Draw the three organs of gynoecium with diagrams.

Solution:

The gynoecium consists of three main parts:

1. **Stigma:** The receptive surface for pollen grains.
2. **Style:** The slender stalk that connects stigma to ovary.
3. **Ovary:** Contains ovules which develop into seeds after fertilization.

Diagram:



External and Internal Structure of Gynoecium

Quick Tip

Remember: Gynoecium consists of stigma (pollen reception), style (connective stalk), and ovary (contains ovules).

(c) Write down the names of three accessory glands of the male sex organ.

Solution:

The three accessory glands of the male reproductive system are:

Seminal Vesicles

These glands produce a significant portion of the fluid that makes up semen. The secretion is rich in fructose, which provides energy for sperm, and other substances like prostaglandins that aid in sperm motility and viability. **Prostate Gland**

The prostate gland secretes a milky, alkaline fluid that helps neutralize the acidic environment of the female reproductive tract, enhancing sperm survival and motility.

Bulbourethral Glands (Cowper's Glands)

These are small glands located below the prostate. They secrete a clear, viscous fluid that lubricates the urethra and neutralizes any residual acidity, preparing the pathway for sperm during ejaculation.

These accessory glands work together to produce and support the transport of semen, ensuring the survival and functionality of sperm.

Quick Tip

Remember: Male accessory glands include seminal vesicles (nutrients), prostate gland (enzymes), and Cowper's gland (lubrication).

(d) Differentiate between primary productivity and secondary productivity.

Solution:

Primary Productivity	Secondary Productivity
Energy production by autotrophs	Energy transfer to consumers
Measured as Gross and Net Productivity	Refers to consumer biomass production
Depends on sunlight and nutrients	Depends on food intake

Quick Tip

Remember: Primary productivity = plants (photosynthesis); Secondary productivity = consumers (energy transfer).

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5. (a) Explain natural selection with an example.

Solution:

Natural selection is the process by which organisms with favorable traits are more likely to survive and reproduce, passing those traits to the next generation.

Example:

The classic example of natural selection is the evolution of the peppered moth (*Biston betularia*) in industrial areas. During the Industrial Revolution, darker moths had a survival advantage as they were better camouflaged against soot-darkened trees, leading to an increase in their population.

Quick Tip

Remember: Natural selection leads to survival of the fittest; an example is the peppered moth adapting to pollution.

(b) Explain the functions of restriction enzyme.

Solution:

Restriction enzymes, also known as molecular scissors, cut DNA at specific recognition sites.

Functions:

1. They cut DNA at specific sequences called restriction sites, producing sticky or blunt ends.
2. Used in genetic engineering for cloning, gene splicing, and DNA analysis.

Quick Tip

Remember: Restriction enzymes cut DNA at specific sites; commonly used in genetic engineering.

(c) Write a note on adaptive radiation.

Solution:

Adaptive radiation is the evolutionary process where organisms diversify rapidly into multiple new forms to adapt to different environmental conditions.

Example:

Darwin's finches in the Galápagos Islands evolved different types of beaks suited to their feeding habits, demonstrating adaptive radiation.

Quick Tip

Remember: Adaptive radiation = evolution of diverse forms from a common ancestor; e.g., Darwin's finches.

(d) Comment on parthenocarpic fruits.

Solution:

Parthenocarpic fruits are fruits that develop without the process of fertilization or seed formation. These fruits are typically seedless, making them desirable for commercial purposes and consumption. The phenomenon of parthenocarpy occurs naturally in some plant species or can be induced artificially through various techniques.

Examples: Banana, seedless grapes.

Importance:

- Beneficial in commercial fruit production.
- Enhances fruit quality and shelf life.

Quick Tip

Remember: Parthenocarpic fruits develop without fertilization and are seedless, e.g., banana and seedless grapes.

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6. (a) Define divergent evolution with example.

Solution:

Divergent evolution refers to the process by which two or more related species evolve different traits or characteristics due to adaptation to different environments or ecological niches. This occurs when a common ancestor splits into multiple descendant species, each evolving unique features as they adapt to their specific habitats or lifestyles. Over time, these differences can lead to significant diversity among species that share a common origin.

Example:

The forelimbs of mammals such as bats, whales, and humans share a common ancestral structure but have evolved different functions like flying, swimming, and grasping.

Quick Tip

Remember: Divergent evolution leads to different traits in related species due to different environments; e.g., forelimbs in mammals.

(b) Write a short note on t-RNA.

Solution:

Transfer RNA (t-RNA) is a type of RNA that helps in the translation process by bringing specific amino acids to the ribosome during protein synthesis.t-RNA (Transfer RNA) is a crucial molecule in the process of protein synthesis, acting as an adapter that translates the genetic code carried by mRNA into the corresponding amino acids. It plays a vital role in the translation phase of protein synthesis, ensuring that the correct amino acids are added to the growing polypeptide chain.

Functions of t-RNA:

- Carries amino acids to the ribosome for protein synthesis.
- Recognizes the mRNA codon using its anticodon region.

Quick Tip

Remember: t-RNA carries amino acids to ribosomes and helps decode mRNA during protein synthesis.

(c) Define opioid drugs with an example.

Solution:

Opioid drugs are a class of substances that act on opioid receptors in the brain and nervous system to produce analgesic (pain-relieving) effects. They mimic the action of endorphins, which are natural chemicals in the body that reduce pain and promote feelings of well-being. While opioids are highly effective for pain management, they also carry a high risk of addiction, dependence, and overdose due to their psychoactive properties. Opioid drugs are a

class of pain-relieving medications that act on the nervous system to relieve pain by binding to opioid receptors.

Example: Morphine is a commonly used opioid drug to manage severe pain in patients.

Quick Tip

Remember: Opioids are pain-relieving drugs that act on the nervous system; an example is morphine.

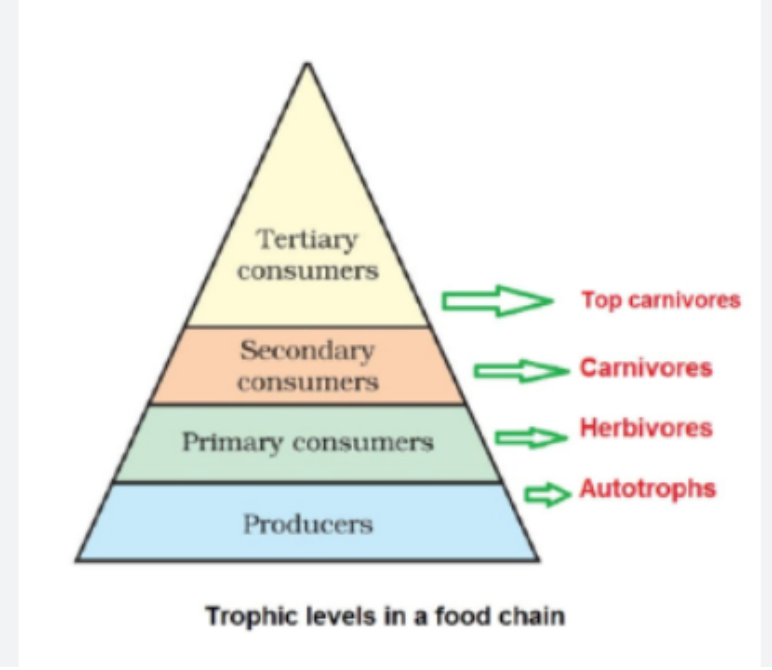
(d) Draw different trophic levels in an ecosystem with a line diagram.

Solution:

Trophic levels represent the feeding position of organisms in an ecosystem. The main trophic levels are:

- **Producers (1st level):** Green plants (autotrophs).
- **Primary consumers (2nd level):** Herbivores.
- **Secondary consumers (3rd level):** Carnivores.
- **Tertiary consumers (4th level):** Top predators.

Diagram:



Trophic levels in a food chain

Quick Tip

Remember: Trophic levels show energy flow, starting with producers and moving to primary, secondary, and tertiary consumers.

Long Answer Type Questions I

7. Write an essay on the importance of Biotechnology in Agriculture.

Solution:

Biotechnology plays a crucial role in modern agriculture by improving crop yield, enhancing resistance to pests and diseases, and promoting sustainable farming practices.

Importance of Biotechnology in Agriculture:

1. **Genetically Modified (GM) Crops:**
   - Crops like Bt cotton and golden rice are engineered for higher yield and pest resistance.
   - GM crops reduce the need for chemical pesticides, leading to eco-friendly farming.
2. **Improved Crop Quality:**
   - Enhances nutritional content, such as increased vitamin A in golden rice.
3. **Pest and Disease Resistance:**
   - Crops are engineered to resist pests, viruses, and fungi, reducing crop losses.
4. **Drought and Stress Tolerance:**
   - Genetically modified crops can withstand drought and adverse environmental conditions.
5. **Tissue Culture Technology:**
   - Helps in the mass production of disease-free plants.

Conclusion:

Biotechnology in agriculture contributes to food security, environmental sustainability, and the economic growth of farmers.

Quick Tip

Remember: Biotechnology improves agricultural productivity through GM crops, pest resistance, and stress tolerance.

OR Describe the polymerase chain reaction with line diagram.

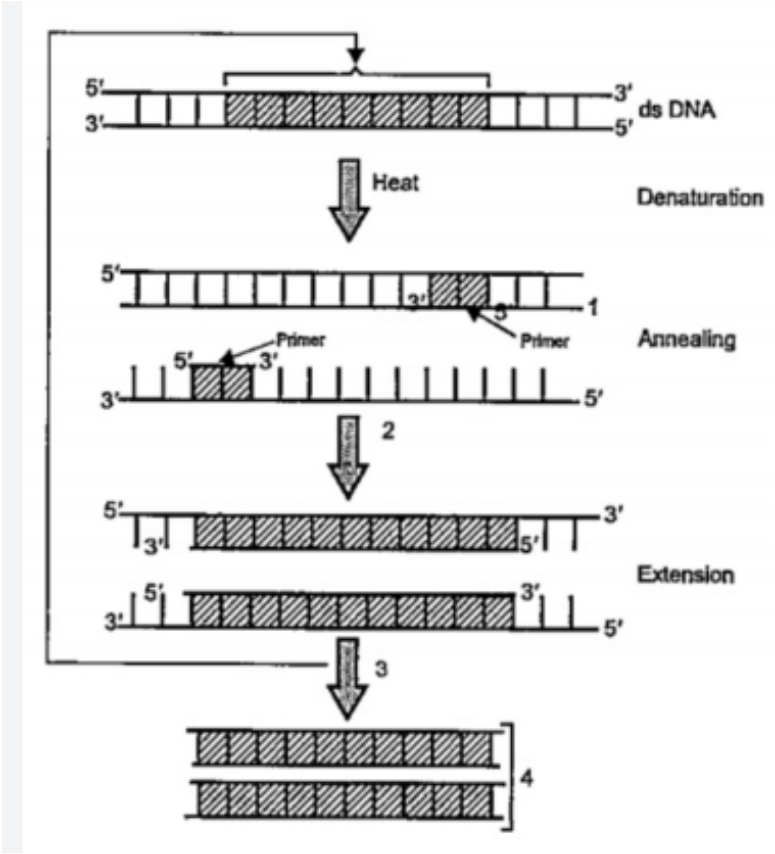
Solution:

Polymerase Chain Reaction (PCR) is a technique used to amplify a specific segment of DNA, making millions of copies from a small sample.

Steps of PCR:

1. **Denaturation:** DNA is heated to around 94-98°C to break hydrogen bonds, separating it into single strands.
2. **Annealing:** Primers bind to the complementary DNA sequence at around 50-65°C.
3. **Extension:** DNA polymerase synthesizes a new DNA strand by adding nucleotides at around 72°C.

Diagram:



Applications of PCR:

- Used in medical diagnostics to detect genetic disorders and infectious diseases.
- Essential in forensic science for DNA fingerprinting.
- Applied in genetic research and cloning.

Quick Tip

Remember: PCR involves denaturation, annealing, and extension; it is used for amplifying DNA in medical and forensic applications.

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8. Describe Biogas plant with diagram.

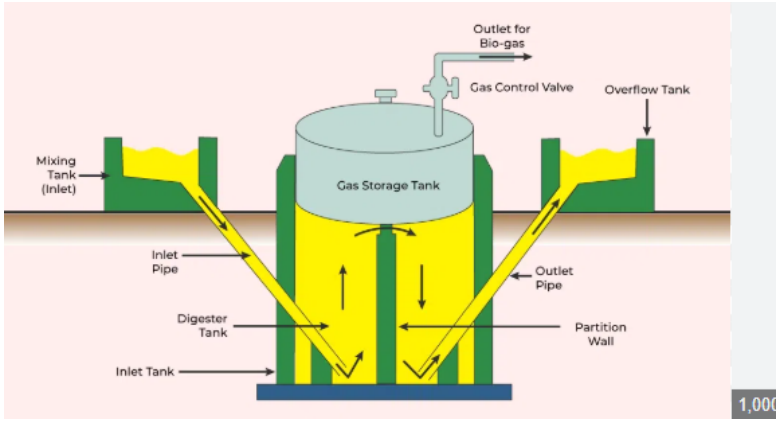
Solution:

A biogas plant is a system that converts organic waste such as animal dung, plant material, and kitchen waste into biogas through anaerobic digestion. The biogas produced is primarily composed of methane (CH4) and carbon dioxide (CO2), which can be used for cooking and electricity generation.

Components of a Biogas Plant:

1. **Inlet Tank:** Organic waste is mixed with water and fed into the digester.
2. **Digester:** A sealed chamber where anaerobic bacteria break down the waste to produce biogas.
3. **Gas Holder:** Collects the biogas generated during decomposition.
4. **Outlet Tank:** The remaining slurry is removed and used as manure.

Diagram:



Advantages of Biogas:

- Provides a renewable and eco-friendly energy source.
- Reduces dependence on fossil fuels.
- Produces nutrient-rich organic fertilizer.

Quick Tip

Remember: A biogas plant converts organic waste into methane-rich gas through anaerobic digestion for cooking and energy.

OR What is cancer? Describe the causes and treatment of cancer in detail.

Solution:

Cancer is a group of diseases characterized by uncontrolled cell growth and division, leading to the formation of tumors that can invade surrounding tissues and spread to other parts of the body.

Causes of Cancer:

- **Genetic Factors:** Inherited mutations in specific genes.
- **Carcinogens:** Exposure to tobacco smoke, radiation, and harmful chemicals.
- **Viral Infections:** Certain viruses such as HPV and Hepatitis B can trigger cancer.
- **Lifestyle Factors:** Poor diet, lack of physical activity, and excessive alcohol consumption.

Treatment of Cancer:

1. **Surgery:** Physical removal of the tumor.
2. **Radiation Therapy:** Using high-energy rays to destroy cancer cells.
3. **Chemotherapy:** Use of drugs to kill or slow the growth of cancer cells.
4. **Immunotherapy:** Boosting the body's immune system to fight cancer.

Quick Tip

Remember: Cancer is caused by genetic and environmental factors; treatments include surgery, radiation, chemotherapy, and immunotherapy.

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9. Write an essay on human evolution.

Solution:

Human evolution refers to the gradual development of modern humans from primate ancestors over millions of years. It involves changes in physical, behavioral, and genetic traits that have occurred over time.

Stages of Human Evolution:

1. **Australopithecus:**
    - Lived around 4-2 million years ago in Africa.
    - Walked upright but had a small brain.
2. **Homo habilis:**

- Known as ”handy man” for using tools.
- Lived around 2 million years ago.

3. **Homo erectus:**
   - First species to use fire and migrate out of Africa.
   - Lived around 1.5 million years ago.
4. **Homo neanderthalensis:**
   - Lived in Europe and Asia; adapted to cold climates.
   - Used advanced tools and burial practices.
5. **Homo sapiens:**
   - Modern humans with advanced cognitive abilities.
   - Evolved around 200,000 years ago in Africa.

Conclusion:

Human evolution is an ongoing process influenced by environmental adaptations, genetic mutations, and cultural advancements.

Quick Tip

Remember: Human evolution involves Australopithecus to Homo sapiens, with key milestones in brain development and tool use.

OR Explain linkage and recombination with example.

Solution:

Linkage and recombination are important concepts in genetics that explain the inheritance of genes located on chromosomes.

Linkage:

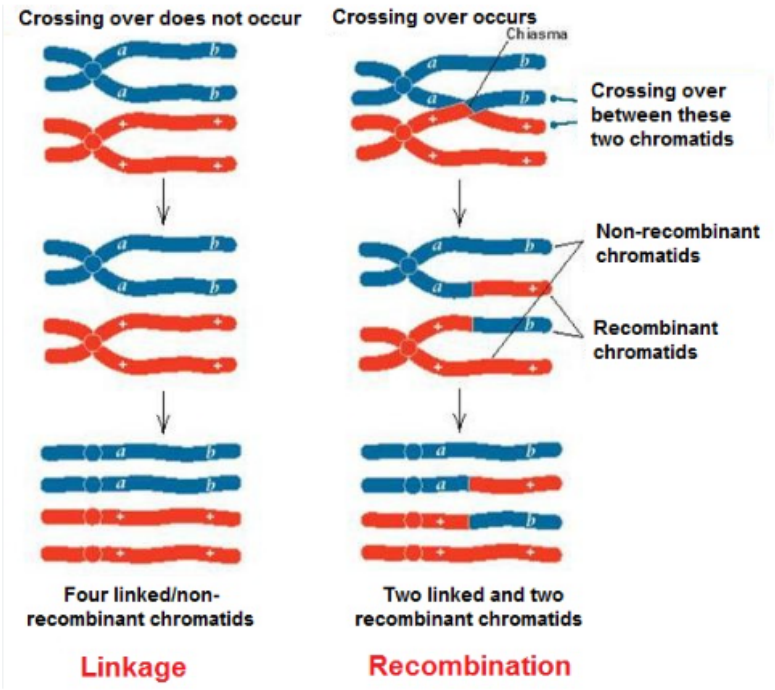
- Linkage is the tendency of genes located close together on the same chromosome to be inherited together.
- It was first observed by Thomas Morgan in fruit flies (*Drosophila*).

- Example: Genes for body color and wing shape in fruit flies show linkage.

Recombination:

- Recombination is the exchange of genetic material between homologous chromosomes during meiosis, leading to new genetic combinations.
- It increases genetic diversity and occurs due to crossing over in meiosis.
- Example: Crossing over between maternal and paternal chromosomes results in new traits in offspring.

Diagram:



Conclusion:

While linkage tends to keep genes together, recombination creates genetic variation, which is crucial for evolution and adaptation.

Quick Tip

Remember: Linkage keeps genes inherited together; recombination introduces new gene combinations through crossing over.