LIBERTY PAPER SET

STD. 12 : Biology

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 10**

Part A

1. (C) **2.** (B) **3.** (C) **4.** (C) **5.** (D) **6.** (B) **7.** (D) **8.** (C) **9.** (D) **10.** (C) **11.** (D) **12.** (B) **13.** (A) **14.** (A)
15. (B) **16.** (B) **17.** (A) **18.** (B) **19.** (A) **20.** (A) **21.** (C) **22.** (A) **23.** (B) **24.** (B) **25.** (D) **26.** (C) **27.** (C)
28. (B) **29.** (C) **30.** (A) **31.** (D) **32.** (A) **33.** (B) **34.** (C) **35.** (C) **36.** (B) **37.** (D) **38.** (D) **39.** (C) **40.** (C)
41. (B) **42.** (A) **43.** (D) **44.** (B) **45.** (C) **46.** (D) **47.** (B) **48.** (D) **49.** (A) **50.** (B)

Section A

➢ **Write the answer of the following questions : (Each carries 2 Mark)**

1.

➥ Chasmogamous flowers are the flowers that have open petals such that the reproductive organs are exposed to allow cross-pollination. On the contrary cleistogamous flowers are small, closed flowers with unexposed reproductive organs. Therefore, they cannot undergo cross-pollination. However, they undergo self-pollination since the stigma and anther are present near each other.

2.

➥ Yes, the use of contraceptives is justified because of following reason :

- These help in controlling the rapid growth of human population.
- These do not interfere with the sexual desire or act.
- These are also helpful in preventing unwanted pregnancies and controlling STIs.
- They do not have any side effect.

3.

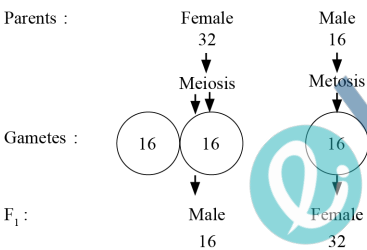
➥ The sex determination in honey bee is based on the number of sets of chromosomes an individual receives.

➥ An offspring formed from the union of a sperm and an egg develops as a female (queen or worker), and an unfertilised egg develops as a male (drone) by means of parthenogenesis.

➥ This means that the males have half the number of chromosomes than that of a female.

➥ The females are diploid having 32 chromosomes and males are haploid. i.e. having 16 chromosomes.

➥ This is known as haplodiploid sex-determination system and has special characteristic features such as males produce sperms by mitosis they do not have father and thus cannot have sons, but have grandfather and can have grandsons.

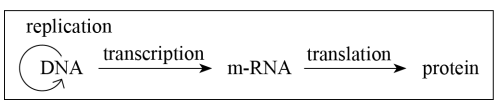


Sex determination in honey bee

4.

➥ The proposition of a double helix structure for DNA and its simplicity in explaining the genetic implication became revolutionary.

➥ Very soon, Francis Crick proposed the Central dogma in molecular biology, which states that the genetic information flows from DNA → RNA → Protein



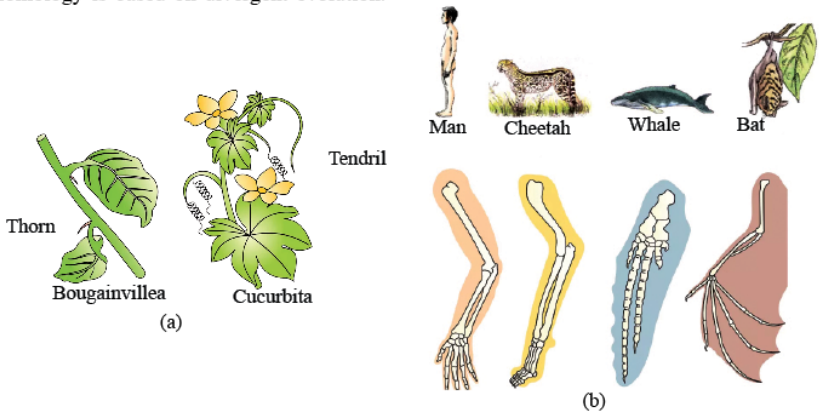
➥ In some viruses, the flow of information is in reverse direction, that is, from RNA to DNA. It is called reverse transcription.

5.

(a) Homologous organ (Divergent evolution)

- For example whales, bats, Cheetah and human (all mammals) share similarities in the pattern of bones of forelimbs (Figure).
- Though these forelimbs perform different functions in these animals, they have similar anatomical structure – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs. Hence, in these animals, the same structure developed along different directions due to adaptations to different needs.

- This is **divergent evolution** and these structures are **homologous**.
- Homology indicates common ancestry.
- Other examples are vertebrate hearts or brains.
- In plants also, the thorn and tendrils of Bougainvillea and Cucurbita represent homology (Figure).
- Homology is based on divergent evolution.



Example of homologous organs in (a) Plants and (b) Animals

(b) Analogous organ (Convergent evolution)

- Whereas analogy refers to a situation exactly opposite.
- Wings of butterfly and of birds look alike. They are not anatomically similar structures though they perform similar functions.
- Hence, analogous structures are a result of **convergent evolution -** different structures evolving for the same function and hence having similarity.
- Other examples of analogy are the eye of the octopus and of mammals or the flippers of Penguins and Dolphins.
- One can say that it is the similar habitat that has resulted in selection of similar adaptive features in different groups of organisms but toward the same function: Sweet potato (root modification) and potato (stem modification) is another example for analogy.

6.

- When the functions of one or more organs or systems of the body are adversely affected, due to which various signs or symptoms are observed. It is called a disease.
- When we say that we are not healthy, that means we are sick.
- Diseases are mostly divided in to groups like infectious and non-infectious or communicable or non-communicable.
- Communicable diseases : Diseases that can be transfered/spread easily from one person to another are called communicable diseases. Infectious diseases are common but some infectious diseases such as AIDS are fatal.
- Non-communicable diseases : Diseases which can not be spread from one person to another are called non-communicable diseases.
- Cancer is a non-communicable disease, but it is a main reason of death.
- Consumption of intoxicating substances and alcohol also adversely affects our health.

7.

- Yes, microbes are used as a source of energy.
- For example microbes are used to produce biogas or gobar gas from dung and bio waste.
- Biogas-gobar gas is a product of anaerobic respiration of which main component is methane gas.
- The spent slurry from the biogas plant is used as fertiliser.

8.

- Connell's elegant field experiments showed that on the rocky sea coasts of Scotland, the larger and competitively superior barnacle Balanus dominates the intertidal area, and excludes the smaller barnacle Chathamalus from that zone.

9.

➥ The important differences between microsporogenesis and megasporogenesis are mentioned below :

➥

	Microsporogenesis	Megasporogenesis
(i)	It is the process in which a diploid microspore mother cell undergoes meiosis to form haploid microspores.	It is the process of formation of haploid megaspores from the diploid mother cell.
(ii)	Occurs inside pollen sacs. Pollens are produced by microsporogenesis.	Occurs inside ovules. Embryo sacs are produced by megasporgenesis.
(iii)	The arrangement of microspores is tetrahedral.	The arrangement of megaspores is linear.
(iv)	All the four microspores formed are functional.	Only one out of the four megaspores formed is functional.

➥ Meiotic cell division occurs during megasporogenesis and microsporogenesis. It is also known as reductional division that leads to the production of haploid gametes.

➥ The structures formed at the end of these events are :

- Microsporogenesis – Pollen grain
- Megasporogenesis – Embryo sac

10.

➥ Removal of gonads cannot be considered as a contraceptive option because it will lead to permanent infertility.

➥ Also it will stop the secretion of various important hormones necessary for the body.

➥ Other contraceptive can be used instead of removal of gonads.

➥ Only such contraceptives can be used which can prevent fertilisation instead of permanent infertility.

11. Explain population attributes.

➥ A population has certain attributes whereas, an individual organism does not.

➥ An individual may have births and deaths, but a population has birth rates and death rates.

➥ In a population these rates refer to per capita births and deaths. The rates, hence, expressed are change in numbers (increase or decrease) with respect to members of the population

➥ **Birth rates :** Refer to per capita births. E.g. In a pond, there are 20 lotus plants last year Through reproduction 8 new plants are added. Hence, the current population - 28 The birth rate 8/20-0.4 offspring per lotus per year.

➥ **Death rates :** Refer to per capita deaths.

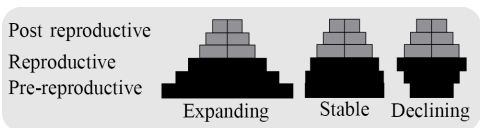
E.g. 4 individuals in a laboratory population of 40 fruit flies died during a week. Hence, the death rate=4/40-0.1 individuals per fruit fly per week.

➥ **Sex ratio :** A population has a sex ratio.

E.g. 60% of the population is females and 40% males

➥ **Age pyramid :** It is the structure obtained when the age distribution (% individuals of a given age or age group) is plotted for the population.

➥ For human population, age pyramids generally show age distribution of males and females in a combined diagram.



➥ **Population size or population density (N) :** It is the number of individuals of a species per unit area or volume.

➥ E.g. population density of Siberian cranes at Bharatpur wetlands in any year is <10. It is millions for *Chlamydomonas* in a pond.

➥ Growth status Expanding (growing) Representation of age pyramids for human population, population size is also measured in **% cover or biomass.**

- E.g. In an area, 200 Parthenium plants and a huge banyan tree are seen. In such cases, measuring % cover or biomass is meaningful to show importance of banyan tree.
- Total number is a difficult measure for a huge population. In such cases, **relative population density** (without knowing absolute population density) is used.
- E.g. Number of fish caught per trap indicates its total population density in the lake.
- In some cases, indirect estimation of population sizes is performed. E.g. Tiger census in national parks & tiger reserves based on pug marks & fecal pellets.

12.

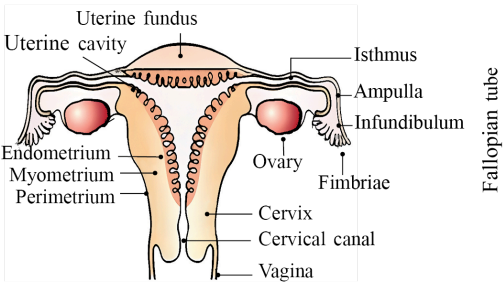
- (a) Grazing food chain and Detritus food chain

Grazing food chain	Detritus food chain
It starts from green plants-producers which are placed at first trophic level.	It starts with the decomposers which degrade detritus like dead animals or fallen leaves etc.
In this food chain energy is obtained directly from sun light.	In this food chain energy is derived from the decomposition of detritus material.
It is controlled by higher organisms.	This is controlled by microbes.
The rate of energy flow is less.	The rate of energy flow is high.

Section B

Write the answer of the following questions : (Each carries 4 Mark)

13.



- The oviducts (fallopian tubes), uterus and vagina constitute the female accessory ducts.
- Structure of Oviducts :
  - Each fallopian tube is about 10-12 cm long.
  - It extends from the periphery of each ovary to the uterus.
  - The part closer to the ovary is the funnel-shaped infundibulum.
  - The edges of the infundibulum possess finger-like projections called fimbriae, which help in collection of the ovum after ovulation.
  - The infundibulum leads to a wider part of the oviduct called ampulla.
  - The last part of the oviduct, isthmus has a narrow lumen and it joins the uterus.
- Structure of Uterus :
  - The uterus is single and it is also called womb.
  - The shape of the uterus is like an inverted pear.
  - It is supported by ligaments attached to the pelvic wall.
  - The wall of the uterus has three layers of tissue.

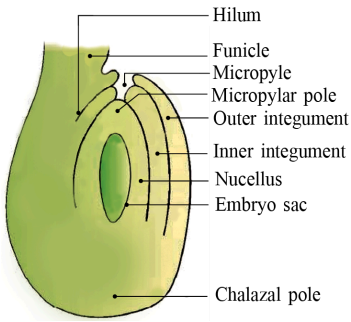
(i) The external thin membranous perimetrium.

(ii) middle thick layer of smooth muscle, myometrium.

(iii) inner glandular layer called endometrium that line the uterine cavity.

- The endometrium undergoes cyclical changes during menstrual cycle while the myometrium exhibits strong contraction during delivery of the baby.
- 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.

14.



- An ovule is a female megasporangium where the formation of megaspores takes place.
- The various parts of an ovule are –
- Funicle – It is a stalk-like structure which represents the point of attachment of the ovule to the placenta of the ovary.
- Hilum – It is the point where the body of the ovule is attached to the funiculus.
- Integuments – They are the outer layers surrounding the ovule that provide protection to the developing embryo.
- Micropyle – It is a narrow pore formed by the projection of integuments. It marks the point where the pollen tube enters the ovule at the time of fertilization.
- Nucellus – It is a mass of the parenchymatous tissue surrounded by the integuments from the outside. The nucellus provides nutrition to the developing embryo. The embryo sac is located inside the nucellus.
- Chalazal – It is the basal part of the ovule in plants, where nucellus and integuments join.

15.

- Another interesting observation supporting evolution by natural selection comes from England.
- In a collection of moths made in 1850s, i.e., before industrialisation set in, it was observed that there were more white-winged moths on trees than dark-winged or melanised moths.
- However, in the collection carried out from the same area, but after industrialisation, i.e., in 1920, there were more dark-winged moths in the same area, i.e., the proportion was reversed.
- The explanation put forth for this observation was that 'predators will spot a moth against a contrasting background'.

- During post-industrialisation period, 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 melanised moth survived.

(a) (b)

Figure showing white - winged moth and dark - winged moth (melanised) on a tree trunk
(a) In unpolluted area (b) In polluted area

- Before industrialisation set in, thick growth of almost white-coloured lichen covered the trees - in that background the white - winged moth survived but the dark-coloured moth were picked out by predators.
- Lichens can be used as industrial pollution indicators. They will not grow in areas that are polluted.
- Hence, moths that were able to camouflage themselves. i.e., hide in the background, survived.
- This understanding is supported by the fact that in areas where industrialisation did not occur e.g., in rural areas, the count of melanic moths was low.
- This showed that in a mixed population, those that can better-adapt, survive and increase in population size.
- Remember that no variant is completely wiped out.
- Similarly, excess use of herbicides, pesticides etc., has only resulted in selection of resistant varieties in a much lesser time scale.
- This is also true for microbes against which we employ antibiotics or drugs against eukaryotic organisms / cell.
- Hence, resistant organisms / cells are appearing in a time scale of months or years and not centuries.
- These are examples of evolution by anthropogenic action.
- This also tells us that evolution is not a directed process in the sense of determinism.
- It is a stochastic process based on chance events in nature and chance mutation in the organisms.

16.

- Worm like *roundworm* and *wuchereria* like filariasis worm (elephantiasis worm) are pathogenic in humans.
- 1) Ascariasis :
  - Intestinal parasitic worms (*Ascaris lumbricoid*) are responsible for this disease.
- Spread through :
  - The eggs of this parasite come out with the faeces of the infected person. It contaminates the soil, water and plants. Its spread in a healthy person is by consuming such contaminated water, vegetables, fruits etc.
- Symptoms :
  - Internal bleeding, muscle pain, fever, anemia and intestinal obstruction.
- 2) Elephantasis -Filariasis :
- Pathogens : *wuchereria (w.bancrofti & w.malayi)*
- Spread through :
  - The pathogen are transmitted to a healthy person through the bite by female mosquito vector (*Culex fatigen*).
- Symptoms :
  - These worms slowly cause chronic inflammation in the lymphatic vessels of animals and remain in the host for years, hence the disease is called elephantiasis.
  - Often the genitals are also affected by this disease, causing many deformities.

17.

- Many products which are useful for mankind are produced by microbes on industrial level.
- For example: beverages, antibiotics, chemicals, enzymes and other biochemical molecules.
- *Saccharomyses cerevisiae*– Yeast is used to prepare wine, beer, whiskey, brandy or rum like beverages and also used for bread making.

  Saccharomyses cerevisiae (brewer's) yeast is used to produce ethanol from cereals and fruit juices.
- Antibiotics are chemical substances which are produced by microbes. They kill pathogenic microbes or slow down their growth. For example: penicillin
- We cannot imagine a world without antibiotics.
- Microbes are also used for commercial and industrial production of certain chemicals like organic acids, alcohols and enzymes.

  Examples :

  Aspergillus niger- citric acid

  Acetobacter aceti- acetic acid

  Clostridium butyricum- butyric acid

18.

- In addition to these uses, GM has been used to create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals.

19.

- Biopiracy is the term used to refer to the use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.
- Most of the industrialised nations are rich financially but poor in biodiversity and traditional knowledge.
- In contrast the developing and the underdeveloped world is rich in biodiversity and traditional knowledge related to bio-resources.
- Traditional knowledge related to bio-resources can be exploited to develop modern applications and can also be used to save time, effort and expenditure during their commercialisation.
- There has been growing realisation of the injustice, inadequate compensation and benefit sharing between developed and developing countries.
- Therefore, some nations are developing laws to prevent such unauthorised exploitation of their bio-resources and traditional knowledge.
- The Indian Parliament has recently cleared the second amendment of the Indian Patents Bill, that takes such issues into consideration, including patent terms, emergency provisions and research and development initiative.

20.

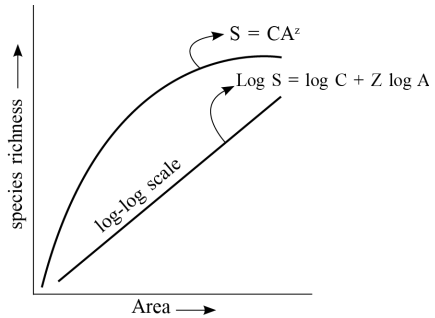
- Ecosystem term is introduced by A. G. Tansly for the first time.
- Ecosystem is a result of interaction between all living and non living factors of environment.
- In an Ecosystem, all biotic and abiotic components are linked by unidirectional energy flow and nutrients cycle.
- Biotic components : plants, animals, microbes.
- Abiotic components : solar energy, water, air and land etc.
- Types of ecosystem : Different types of ecosystems of nature, constitute the giant ecosystem-the biosphere. The ecosystems are categorised in to two as follows :
- (1) Natural ecosystems :
  - They are operated by themselves under natural conditions without any major interference by man.
- (2) Man-made ecosystems crop fields and aquarium
- Based upon the particular kind of habitat, these are further divided as :

  (i) Terrestrial ecosystems : (a) forest (b) grassland (c) desert.

  (ii) Aquatic ecosystems : They may be further divided as fresh water and marine water.

21.

- During his pioneering and extensive explorations in the wilderness of South American jungles, the great German naturalist and geographer Alexander von Humboldt observed that within a region species richness increased with increasing explored area, but only up to a limit.
- In fact, the relation between species richness and area for a wide variety of taxa (angiosperm plants, birds, bats, fresh water fishes) turns out to be a rectangular hyperbola.



- On a logarithmic scale, the relationship is a straight line described by the equation
- log S = log C + Z log A
- Where,

  S = Species richness

  A = Area

  Z = slope of the line (regression coefficient)

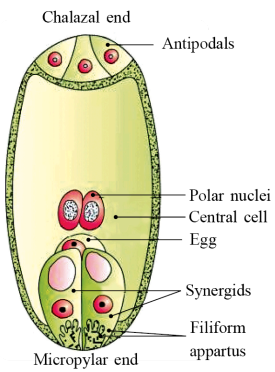
  C = Y-intercept

- Ecologists have discovered that the value of Z lies in the range of 0.1 to 0.2, regardless of the taxonomic group or the region (whether it is the plants in Britain, birds in California or molluscs in New York state, the slopes of the regression line are amazingly similar).
- But, if you analyse the species-area relationships among very large areas like the entire continents, you will find that the slope of the line to be much steeper (Z values in the range of 0.6 to 1.2).
- For example, for frugivorous (fruit-eating) birds and mammals in the tropical forests of different continents, the slope is found to be 1.15.

Section C

➢ **Write the answer of the following questions : (Each carries 4 Mark)**

22.

- 

- The female gametophyte is formed by the mitotic division of the functional megaspore.
- The megaspore divides mitotically thrice to form 8 nucleate embryo sacs. The process of formation of 7-celled, 8 nucleate nature of female gametophyte is mentioned below :

- Two nuclei are formed after the cell undergoes first mitotic division.
- These two nuclei move towards the micropylar end and the chalazal end, respectively.
- They divide and redivide to form 8 nucleate stage.
- Consequently, there are four nuclei each on either ends.
- At the micropylar end, three out of the four nuclei differentiate into an egg cell and synergids.
- At the chalazal end, three out of the four nuclei differentiate as antipodal cells.
- The remaining cells, each from either ends move towards the centre and are known as polar nuclei.
- Therefore on maturation, the female gametophyte looks like a 7-celled structure.

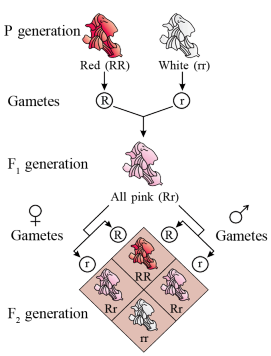
23.

- (i) Menarche - The first menstruation begins at puberty and is called menarche.
- (ii) Menopause - In human beings, menstrual cycles ceases around 50 years of age; that is termed as menopause.
- (iii) Menstrual cycle - In human females, menstruation is repeated at an average interval of about 28/29 days, and the cycle of events starting from one menstruation till the next one is called the menstrual cycle.
- Menstrual cycle: It is the reproductive cycle of female primates (such as monkeys, apes, and humans).
- The menstrual cycle is the sequence of events that begins with one menstruation and ends with the next.
- Menstruation occurs every 28/29 days in human females.
- Menstruation, the follicular phase, ovulation, and the luteal phase are the four phases of the menstrual cycle.
- Hormones that regulate the menstrual cycle are: Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Estrogen and Progesterone.

24.

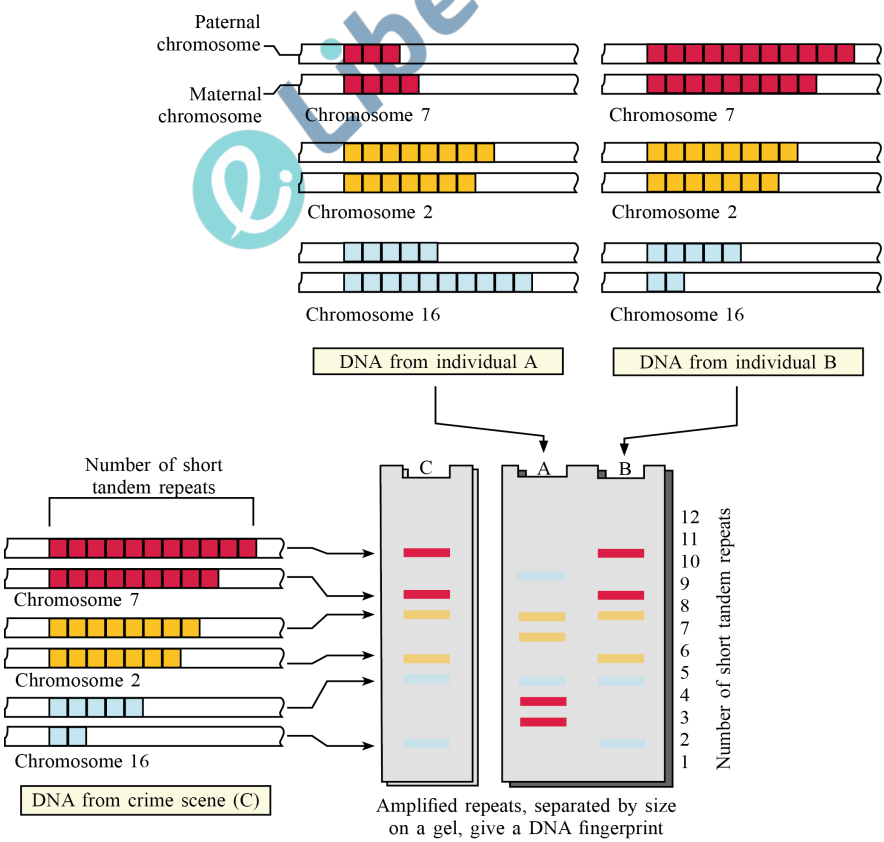
- When experiments on peas were repeated using other traits in other plants, it was found that sometimes the F_1 had a phenotype that did not resemble either of the two parents and was in between the two.
- The inheritance of flower colour in the dog flower (snapdragon or Antirrhinum sp.) is a good example to understand incomplete dominance.
- In a cross between true-breeding red-flowered (RR) and true breeding white-flowered plants (rr). the F_1 (Rr) was pink.
- When the F_1 was self-pollinated, the F_2 resulted in the following ratio 1 (RR) Red : 2 (Rr) Pink : 1 (rr) White.
- Here the genotype ratios were exactly as we would expect in any Mendelian monohybrid cross, but the phenotype ratios had changed from the 3 : 1 dominant : recessive ratio. What happened was that R was not completely dominant over r and this made it possible to distinguish Rr as pink from RR (red) and rr (white).
- Obtained Genotypic & Phenotypic Ratio is as follows :

Phenotypic ratio	Red : Pink : White 1 : 2 : 3
Genotypic ratio	RR : Rr : rr 1 : 2 : 1



25.

- 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 known as Variable Number of Tendem Repeats (VNTR).
- The technique, as used earlier, involved Southern blot hybridisation using radiolabelled VNTR as a probe. It included
  - (i) isolation of DNA,
  - (ii) digestion of DNA by restriction endonucleases,
  - (iii) seperation of DNA fragments by electrophoresis,
  - (iv) transferrring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon,
  - (v) hybridisation using labelled VNTR probe, and
  - (vi) detection of hybridised DNA fragmenents by autoradiography. A schematic representation of DNA fingerprinting is shown in Figure.
- The VNTR belongs to a class of satellite DNA referred to as mini-satellite. 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 hybridisation with VNTR probe, the autoradiogram gives many bands of differing sizes.
- There 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 increased by use of polymerase chain reaction (PCR).
- Consequently, DNA from a single cell is enough to perform DNA fingerprinting analysis. In addition to application in forensic science, it has much wider application, such as in determining population and genetic diversities.
- Currently, many different probes are used to generate DNA fingerprints.



26.

- (a) Amoebiasis
- Amoebiasis (Amoebic dysentery) : Pathogen is Entamoeba histolytica.
  - Mode of transmission : Houseflies (mechanical carriers) transmit parasites from faeces to food & water.
  - Symptoms : constipation, abdominal pain and cramps, stools with excess mucus and blood clots.
- (b) Malaria
- Maintaining personal and community hygiene is important for the prevention and control of many infectious diseases.
- Personal hygiene includes keeping the body clean, consuming pure water for drinking, food, vegetables etc.
- Disposal of sewage and excreta in public sanitation, periodic cleaning and keeping of reservoirs, cisterns, cesspools, tanks etc.
- Furthermore, it is necessary to follow the norms of cleanliness even in public use.
- Such measures are especially indispensable in places where infectious pathogens are spread through food and water like typhoid, amoebic, asceriasis etc.
- Close contact with the person as well as the use of items used in their mouth should be avoided as a treatment for the mentioned remedies used in air-borne diseases like pneumonia and cold.
- In insect-borne diseases like malaria and filariasis, the control and destruction of vectors and their breeding sites is essential.
- To achieve this purpose, water should not be allowed to accumulate in and around the residential area. Regular cleaning of the cooler used in the house is also a must.
- Use Gambusia fish which eat mosquito eggs.
- Places like pits, drainage, mud should be sprayed with pesticides.
- (c) Ascariasis
  - Intestinal parasitic worms (*Ascaris lumbricoid*) are responsible for this disease.
- Spread through :
  - The eggs of this parasite come out with the faeces of the infected person. It contaminates the soil, water and plants. Its spread in a healthy person is by consuming such contaminated water, vegetables, fruits etc.
- Symptoms :
  - Internal bleeding, muscle pain, fever, anemia and intestinal obstruction.
- (d) Pneumonia
- Pathogen : *Streptococcus pneumonia and Haemophiles influenza*
- Spread through :
  - Droplets or aerosols released by an infected person through coughing or sneezing. Inhalation or by using the utensils of an infected person.
  - As a result of infection, the alveoli get filled with fluid leading to severe problem in respiration.
- Symptoms :
  - Fever, chills, cough and headache
  - In severe condition, the lips and fingers become gray to blue in color.
- Treatment : Antibiotics

27.

- There are many techniques by which recombinant DNA is inserted into competent host cell.
- When host cell becomes competent, it accepts recombinant DNA.
- If recombinant DNA contains antibiotic resistance gene (eg. Ampicillin), it transforms host cell into ampicillin resistance cell.
- Such transformant cell, when grow on agar plate containing ampicillin, only transformants can grow on this plates and non transformants dies beacause, transformants contains ampicillin resistance gene.
- In such case ampicillin antibiotic resistance gene act as a selectable marker.