CBSE Board

Class XII Biology (Theory)

Board Question Paper 2014 – Set 1

Time: 3 hrs **Max. Marks: 70**

SECTION-A

1. **Ans**. The tassels of the corn-cob represent the male part of a plant which produces pollen grains.

2. **Ans.** The contrasting traits with respect to seeds in pea plants are:
   i. Seed shape - Smooth / Round (Dominant); Wrinkled (Recessive)
   ii. Seed colour – Yellow (Dominant); Green (Recessive).

3. **Ans.** Secondary immune response is more intense than the primary immune response in humans because the antibody titer after subsequent encounters is far greater than the primary response and consists mainly of IgG antibodies.

4. **Ans.** It is not possible for an alien DNA to become part of a chromosome anywhere along its length and replicate normally because replication process begins at a particular spot.

5. **Ans.** C peptide is a prohormone that needs to be processed before it becomes fully mature and is removed during maturation into insulin.

6. **Ans**. Lysozyme is used for the isolation of DNA from bacterial cells and chitinase is used for the isolation of DNA from fungal cells.

7. **Ans.** Gause's Competitive Exclusion Principle states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior will be eliminated eventually.

8. **Ans.** Glomus exhibits symbiotic association with higher plants.

SECTION-B

9. **Ans.** Human testes are located outside the abdominal cavity to avoid high abdominal temperature. Testes are suspended in a pouch called scrotum.

10. Ans.

(a) When the red and white flowers varieties of snapdragon are crossed, the F_1 progeny exhibits pink colour flowers. It is not known as blending inheritance because in blending inheritance, the characters are mixed in the offsprings.

(b) This phenomena is known as incomplete dominance.

11. Ans. Codominance: When both alleles of a pair are fully expressed in a heterozygote, the genes and trait are said to be codominant. Example – A person of blood group AB is an example of codominance where allele I^A for A-type blood is codominant with its allele I^B for B- type blood. The heterozygote (I^AI^B) expresses the characteristics of both A and B antigens.

Multiple allelism: It is phenomena that occur when more than two alleles exist at a given locus of a chromosome and in a given individual, only two of these alleles occur, one derived from each parent. Example – ABO blood types in humans is an example of multiple allelism where alleles IA, IB and i produce the four phenotypes (A, B, AB and O) of blood groups.

12. Ans. The scientific name of fruit-fly is Drosophila melanogaster. Morgan preferred to work with fruit-flies for his experiments because:

i. It is simple and convenient to breed under laboratory conditions throughout the year.
ii. Its generation time is only 10-12 days.
iii. It breeds quickly and prolifically and so produces large progeny after each mating.

OR

The linked genes do not always remain linked but are occasionally departed from other members of their linkage groups by crossing over. But the frequency of crossing over depends upon the distances between the various genes located on the same chromosome. If the distance between the genes is more, then chances of crossing over and recombination are more. If the genes are closely placed on the same chromosome and the frequency of their separation is less than 50%, then there are less chances of departure or crossing over. In this case, the genes will remain linked and the progeny will be parental type.

13. Ans. Symptoms of Ascariasis:

i. Internal bleeding
ii. Muscular pain
iii. Fever
iv. Anemia
v. Blockage of the intestinal passage

A healthy human being acquires this infection through contaminated water, vegetables and fruits, etc.

14. Ans. Nucleopolyhedrovirus are the biological control agents that attack insects and other arthropods. These viruses are excellent candidates for species-specific and have no negative impacts on plants and other organisms or even non-target insects.

15. Ans. Nucleases are enzymes that degrade the DNA molecules by breaking phosphodiester bonds that hold nucleotides together.
There are two types of nucleases, endonucleases that act on internal phosphodiester bonds within a DNA molecule while exonucleases degrade DNA and remove nucleotides from the end of the DNA molecule.
Action of nucleases: Endonucleases cleave the double-stranded DNA at specific sequences internally while exonuclease chew up nucleotides from either end of the double-stranded DNA while exonucleases degrade DNA and remove nucleotides from the end of the DNA molecule.

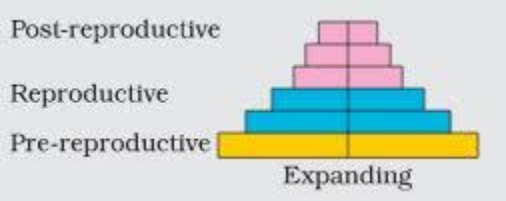
16. Ans.

(a) Biological products: Many human diseases are controlled by the biological products. The transgenic animals which produce these products are introduced with DNA which codes for a particular product like human protein for treating emphysema. In 1997, the first transgenic cow, Rosie was produced, capable of secreting human protein-enriched milk.

(b) Chemical safety testing: The transgenic animals are tested to study the sensitivity of the toxic substances. Toxicity testing in such animals help the man to obtain results in less time.

17. Ans. Mutualism interaction exists between fig tree and wasp. In fig tree there is a tight one-to-one relationship with a pollinator species of wasp. A fig species is pollinated only by its 'partner' wasp species and no other species. The female wasp uses the fruit not only as an oviposition but uses the developing seeds within the fruit for nourishing its larvae. The wasp pollinates the fig while finding egg-laying sites and in turn, fig offers the wasp developing seeds, as food for the developing larvae.

18. Ans.



SECTION-C

19. Ans. The outbreeding devices in flowering plants that encourages cross pollination are:

i. Dicliny: Flowers are unisexual so that self pollination is not possible. The plants may be monoecious (bearing both male and female flowers, e.g., maize) or dioecious (bearing male and female on different plants, e.g., mulberry, papaya).

ii. Prepotency: Pollen grains of another flower germinate more rapidly over the stigma than the pollen grains of the same flower, e.g., Apple, Grape.

iii. Self Sterility: Pollen grains of a flower do not germinate on the stigma of the same flower due to presence of similar self sterile gene (s_1s_3 in pistil and s_1 or s_3 in pollen grain), e.g., Tobacco, Potato, crucifers.

OR

A typical angiosperm anther is bilobed and each lobe has two theca so it is called as dithecous.

A microsporangium is a cylindrical sac which appears circular in transverse section.

It contains following parts:

i. Outer wall.

ii. Central homogenous sporogenous tissue.

iii. Epidermis.

iv. Endothecium.

v. 1-3 middle layers and taetum.

The outer three layers performs the function of protection in the younger anther and mechanism of dehiscence in the ripe another.

The endothecial cells develop fibrous thickening of α-cellulose on the inner and radial walls and become dead.

20. Ans.

(a) Yes, the test must be banned because of its misuse to determine the sex of the foetus. Due to small family norm, every family wants a male child. The female foetus is destroyed. This has resulted in decline in female population which can create social problems for the future generations.

(b) Many genetic disorders, if present can be diagnosed with the help of amniocentesis.

21. Ans. Pedigree analysis is done in the study of human genetics as:

i. It helps the genetic counsellors to guide the couples about the possibility of having children with genetic defects like hemophilia.

ii. It indicates that Mendel's principles are also applicable to human genetics with some modifications found out later like quantitative inheritance, sex linked characters and other linkages.

Pedigree analysis is study of pedigree for the transmission of particular trait and finding the possibility of absence or presence of that trait in homozygous or heterozygous state in a particular individual.

22. Ans.

No.	**Syndrome**	**Cause**	**Characteristics of affected individuals**	**Sex/Male/Female/Both**
1.	Down's	Trisomy of 21	**(i) Broad fore-head.** **(ii) Permanently open mouth, protruding and furrowed tongue and projecting lower lip.**	**Both**
2.	**Klinefelter's**	XXY	Overall masculine development	**Male**
3.	**Turner's**	45 with XO	**(i) Short stature females with webbed neck.** **(ii) Body hairs are absent.**	**Female**

23. Ans.

(a) There is a need to organize such visits to make people aware of personal and public hygiene. Maintenance of personal and public hygiene is very important for prevention and control of many infectious diseases.

(b) Steps to be highlighted are:
Personal hygiene includes:
i. Consumption of clean drinking water, food vegetable fruits.
ii. Keeping the body cleans.

Public hygiene includes:
i. Proper disposal of waste and excreta
ii. Periodic cleaning and disinfection of water reservoirs, pools, cesspools.
iii. Standard practices of hygiene in public catering.

In case of air-borne diseases, close contact with the infected persons or their belongings should be avoided.

24. Ans.

(a) German naturalist and geographer Alexander von Humboldt studied the species area relationship. Within a region, the species richness increases with increasing explored area but only upto a limit. The relationship between species richness and area for a wide variety of taxa turns out to be rectangular hyperbola.

(b) (i) If the value of Z lies in the range of 0.1 to 0.2, it is regardless of taxonomic group or the region.
(ii)If the value of Z lies in the range of 0.6 to 1.2, then the slope of the line will be much steeper.
Z stands for slope of the line or regression coffiecient.

(c) If the species-area relationship is for very large areas like entire continent, the slope of the line will be much steeper.

25. Ans. The technique that helps in separating the DNA fragments formed by the use of restriction endonuclease is DNA fingerprinting.
DNA fingerprinting works as follows:

i. The DNA is extracted from the nuclei of whatever evidence is available for e.g. from WBCs in case of blood sample or from hair follicle cells that cling to the roots of hair that have fallen or have been pulled out ; or from spermatozoans in semen sample.
ii. If the content of DNA is limited, DNA can be amplified by making many copies of it using PCR or Polymerase Chain Reaction.
iii. The DNA sample is digested by a restriction enzyme which cuts the DNA into fragments at specific sites.
iv. These fragments are separated by gel electrophoresis set up containing agarose polymer gel.
v. Double stranded DNA is then split into single stranded DNA using alkaline chemicals.

vi. These separated DNA sequences are transferred to a nylon or nitrocellulose sheet placed over the gel. This is called 'Southern Blotting'.
vii. The nylon sheet is then immersed in a bath and probes or markers that are radioactive, synthetic DNA segments of known sequences are added. The probes target a specific nucleotide sequences which is complementary to VNTR sequences and hybridizes them.
viii. Finally, X-ray film is exposed to the nylon sheet containing radioactive probes. Dark bands develop at the probe sites which look something like the bar codes used to identify items at the grocery store. The degree of variation is so high that every individual with the exception of identical twins , produces a unique band pattern , as every individual has a unique set of ordinary fingerprinting.

26. Ans . The function of the reservoir is to meet the deficit which occurs due to imbalance in the rate of influx and efflux.
Carbon cycle in nature:
i. The main source of carbon in this universe is CO_2 which is dissolved in water and present in air (0.03 – 0.04%).
ii. Plants take up carbon dioxide from the atmosphere and form organic compounds during photosynthesis. These organic compounds are transferred to animals as their food.
iii. The carbon dioxide is returned back to the atmosphere during respiration, decay and combustion of plants and animals.
iv. The organic compounds of plants and animals are buried in the deep soil where they are acted by decomposers to change them in petroleum, coal, oil and carbonate rocks. These substances on their combustion release carbon dioxide into the atmosphere.
v. Some carbon dioxide is found in dissolved state in water. This gets converted into calcium carbonate in lime stone. The weathering and combustion of carbonate containing rocks or treatment of their minerals give CO_2.
vi. The hot springs and volcanic eruptions also give out CO_2 into the atmosphere.

27. Ans.
(a) The current rate of extinction is 100-1000 times faster than pre-human times. It seems that the earth is heading for the sixth extinction but it would anthropogenic.
It is believed that (a) Tropical forests are losing 2-5 species per hour or 14000-40,000 species per year. (b) Ten high diversity localities of tropical forests covering 3,00,000 km^2 area are liable to lose 17,000 endemic plant species and 3,50,000 endemic plant species in the near future. (c) If the current rate of species extinctions goes on unabated, 50% of species are liable to die out by the end of 21^{st} century.
(b) They are extinctions abetted by human activities like settlements, hunting, overexplotation and habitat destruction. Colonisation of tropical pacific islands by humans has resulted in extinction of more than 2000 species of native birds. During the last 500 years, the earth has lost some 784 species (IUCN, 2004). It includes 338 vertebrates, 359 invertebrates and 87 plants. Ambhibians seem to be at higher risk of extinction.

(c) (i) All the threatened species should be protected. Priority should be given to ones belonging to monotypic genera, endangered over vulnerable, vulnerable over rare and rare over other species.
(ii) All the possible varieties, old or new, of food forage and timber plants, livestock, aquaculture animals and microbes are conserved.
(iii)Wild relatives of all the economically important organisms should be identified and conserved in protected areas.
(iv) Critical habitats for feeding/breeding/resting/nursing of each species should be identified and safeguarded.

SECTION-D

28.Ans.

(a) Fertilization in humans occurs in fallopian tube of the female reproductive system.

It is the process of fusion of a haploid sperm and a haploid ovum to form a diploid zygote. The process of fertilization is completed under the following major steps:

(i) Attraction: During copulation (intercourse of coitus), the millions of sperms are inserted into the vagina of the female through the penis. The sperms swim in the fluid mucus lining of the female genital tract at the rate of 1.5 to 3.0mm per minute to reach the ovum in the upper part of fallopian tube where fertilization takes place. The ova are formed in the ovaries, which are released, into abdominal cavity through a process called ovulation. One mature egg is released from the ovary on 14-15 day of the menstrual cycle and that is picked of by the fimbriae of the ampulla of fallopian tube. The ovum enters the fallopian tube and moves in it by the muscular contractions and ciliary action of the epithelium of fallopian tube. The ovum secretes a chemical substance called fertilizin glycoprotein or mocopolyacchride to attract the sperms. The sperms produces a chemical substance antifertilizin (protein). Each species produces specific type of fertilizing and antifertilizin and the reactions between them bring about the process of fertilization.

(ii) Penetration of sperm into ovum: The human ovum is a rounded and non-motile structure surrounded by vitelline membrane, zona pellucid and corona radiata. The radially arranged follicle cells of corona radiate are glued together by a complex organic substance called hyaluronic acid(a mucopolysaccharide) which act as barrier for the entry of sperms. The human sperm undergoes several changes so that it may be able to fertilize the ovum. This is called as capaciation of sperm. The sperm attaches to the surface of the ovum near the animal pole and starts penetrating the various membranes of the egg. The acrosome of the sperm bursts and secretes sperm lysins containing a enzyme hyaluronidase to dissolve the adhesive substance as well as to disperse the cells of corona radiate. Ultimately, with the help of sperm lysin, one sperm penetrates the layers of corona radiata and zona pellucida in about 30 minutes.

(iii) Activation of ovum: Consequent to penetration of sperm, the series of changes are brought about in the egg cortex. The dark cortical granules appear below the cell membrane in the cortex which migrate through the plasma membrane. These granules get attached along the inner surface of vitelline membrane and make it thick. This thickened vitelline membrane is called as fertilization membrane which prevents polyspermy by inhibiting the entry of other sperms.

(iv) Fusion of sperm and ovum nuclei: The sperm entry stimulates the ovum to undergo second meiotic division for removal of last polar body. Usually the sperm head and middle piece enters the ovum through a definite path called copulation path. The sperm nucleus acts as a male gamete and egg nucleus as female gamete. The centrioles of the middle piece of sperm form the spindle and nuclear membranes of the sperm and ovum breaks down. This process of mixing up of haploid sperm nucleus with haploid egg nucleus is called amphimixes. The fusion product of sperm and egg pronuclei results in the formation of diploid zygote which initiates the pregnancy in females.

(b) In vitro fertilization: In this method, the fertilization occurs outside the body and is followed by Embryo transfer (ET). This technique is applied when the fallopian tube of the mother is blocked and she is unable to conceive. In this technique, the egg of a wife/donor is removed and fertilized (in vitro) by the husband/donor sperm outside her body under sterile conditions. The fertilized egg when reaches up to 8 celled stage, it is transferred into the fallopian tube and the embryos more than 8 blastomeres into the uterus to complete its further development.

OR

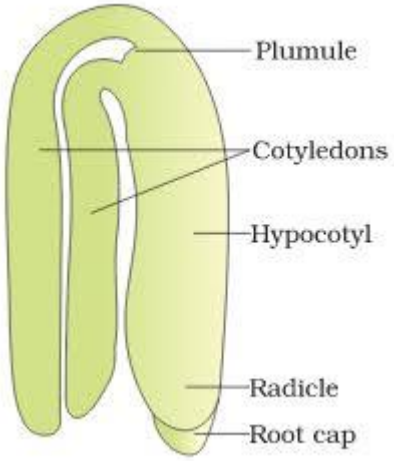
(a) Apomixis (Gk. apo- without, mixis-mixing) is a mode of reproduction which does not involve formation of zygote through gametic fusion. The two common ones are recurrent agamospermy and adventive embryony.

(i) Recurrent Agamospermy: Agamospermy is the formation of seed and has an embryo formed without meiosis and syngamy. It is of two types, noncurrent and recurrent. In noncurrent agamospermy, the embryo is haploid. Therefore, the seed having it is nonviable. In recurrent agamospermy all the cells of embryo sac are diploid as it is formed directly either from a nucellar cell(apospory) or diploid megaspore mother cell(diplospory). The diploid egg as well as other diploid cells of embryo sac can grow into normal embryos. Formation of embryo directly from diploid egg without fertilization is called diploid parthenogenesis, e.g., Rubus, Apple, Poa.

(ii) Adventive Embryony (Sporophytic Budding): An embryo develops directly from a diploid cell other than egg like that of nucellus and integument, e.g., Citrus, Opuntia. It gives rise to a condition called polyembryony or the phenomenon of having more than one embryo. There may be more than one egg cell in an embryo sac or more than one embryo sac in an ovule. All the egg cells may get fertilized. Synergids and antipodal cells may also form embryos. In gymnosperms polyembryony can also occur due to cleavage of growing embryo. It is called cleavage polyembryony. Occurrence of polyembryony due to fertilisation of more than one egg is called simple polyembryony. Formation of extra embryos through sporophytic budding is called adventives polyembryony. Polyembryony is quite common in Onion, Groundnut, Mango, Lemon and Orange.

(b) Embryos formed through apomixes are generally free from infections.

(c)



29. Ans.

(a) S.F. Griffith demonstrated bacterial transformation experimentally by performing experiments on Diplococcus pneumonia. It has two distinct forms – one form secretes a polysaccharide capsule which gives the colonies a smooth appearance and another form is non-capsulated which gives the colonies a rough appearance. The capsule of the smooth form is virulent and gives an infected animal, the disease pneumonia; the rough form (R) is not virulent.

The main steps are as follows:

i. Griffith conducted his experiments on Diplococcus pneumonia that causes pneumonia in mice. He injected 'S' type living bacteria into mice and they died due to pneumonia.

ii. He then injected live non-virulent bacteria (R) into mice and they did not suffer from pneumonia.

iii. He then injected heat killed virulent 'S' type bacteria into mice and they survived equally well.

iv. In the last, he injected a mixture of heat killed 'S' and live 'R' simultaneously, the mice died with the symptoms of pneumonia. Living S type bacteria were recovered from their bodies.

This happened because of something from the dead bacteria had entered the live ones and made them virulent. This means 'R' type of bacteria have been transformed to's' type and this process is called transformation. Thus, transformation is the transferring of characters from one strain to another using DNA extract of the former.

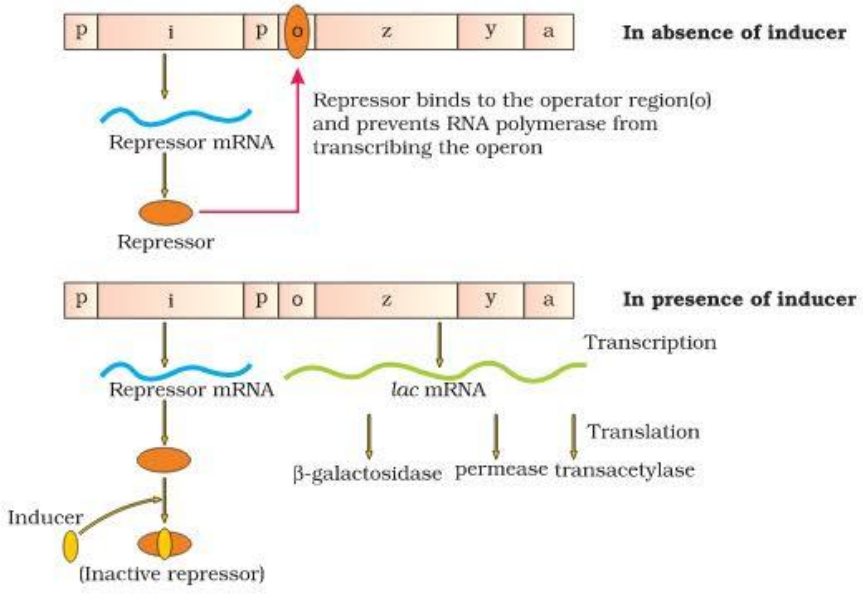
(b) Griffith proposed that the 'transforming principle' is a chemical substance released by heat killed bacteria. It changed the R- bacteria into S – bacteria. It was permanent genetic change as the new S- type bacteria formed only S – type progeny.

OR

Lac operon consists of regulator gene, promoter gene, operatoral gene and structural gene.

The E. coli bacterium carries numerous genes and these genes turn on and off as per requirement. When these genes are turned on, they undergo enzymes which metabolise the new substrate. This phenomenon is known as induction and

small molecules elicting this induction is referred to as inducers. In this lac operon, the presence of lactose acts as an inducer.
The lac operon contains a promotor, an operator and three closely related structural genes, z, y, a coding for enzymes β-galactosidase, β-galactoside permease and β- galactoside transacetylase respectively. β-galactoside permease pumps lactose into the cells whereas β-galactosidase catalyses the conversion of lactose into glucose and galactose. These genes are not expressed in the absence of lactose. The promoter (P) for the operon is the site at which RNA polymerase binds to initiate transcription of the structural genes. The operator (O) is the site at which the protein repressor – the product of regulator gene binds. In the presence of a regulator protein, the RNA-polymerase is prevented from attaching to the promoter.
A regulator gene is a DNA segment independent of an operon and it synthesizes a repressor protein. This protein combines with operator and makes it inactive. This prevents RNA polymerase from binding to the adjoining promoter (P) and from initiating transcription of the structural gene. Therefore, RNA polymerase is required to negotiate the operator before transcription can occur. The repressor binds to the operator in the absence of a metabolite (effector molecule – lactose).
When an inducer or effector molecule-lactose is added to the system, it binds to the repressor to form a complex which is unable to bind the operator. The RNA polymerase enzyme now becomes free to bind with promoter (P) and so operator is switched on. This initiates the transcription of structural genes, producing the three polypeptides. These enzymes bring about the metabolism of lactose into glucose and galactose.



30. Ans. The main steps in breeding a new genetic variety of a crop are:

i. Collection of variability: Collection and preservation of all the different wild varieties, species and relatives of the cultivated species is a pre-requisite for effective exploitation of natural genes available in the populations. The entire collection of plants/seeds having all the diverse alleles for all genes in a given crop is called germplasm collection.

ii. Evaluation and selection of parents: The germplasm is evaluated so as to identify plants with desirable combination of characters. The selected plants are multiplied and used in the process of hybridisation. Pure lines are created wherever desirable and possible.
iii. Cross hybridisation among the selected parents: The desired characters have very often to be combined from two different plants (parents), for example high protein quality of one parent may need to be combined with disease resistance from another parent. This is possible by cross hybridising the two parents to produce hybrids that genetically combine the desired characters in one plant.
iv. Selection and testing of superior recombinants: This step consists of selecting, among the progeny of the hybrids, those plants that have the desired character combination. The selection process is crucial to the success of the breeding objective and requires careful scientific evaluation of the progeny. This step yields plants that are superior to both of the parents (very often more than one superior progeny plant may become available). These are self-pollinated for several generations till they reach a state of uniformity (homozygosity), so that the characters will not segregate in the progeny.
v. Testing, release and commercialization of new cultivars: The newly selected lines are evaluated for their yield and other agronomic traits of quality, disease resistance, etc. This evaluation is done by growing these in the research fields and recording their performance under ideal fertilizer application irrigation, and other crop management practices. The evaluation in research fields is followed by testing the materials in farmers' fields, for atleast three growing seasons at several locations in the country, representing all the agroclimatic zones where the crop is usually grown. The material is evaluated in comparison to the best available local crop cultivar- a check or reference cultivar.

OR

(a) Objectives of animal breeding:
i. The improved growth rate.
ii. Increased production of milk, meat, egg, wool, etc.
iii. Superior quality of milk, meat, eggs, wool, etc.
iv. Improved resistance to various diseases.
v. Increased productive life.
vi. Increased or, atleast, acceptable reproduction rate.

(b) When breeding is between animals of the same breed for 4-6 generations, it is called inbreeding.
Inbreeding can be explained by taking an example of cows and bulls. Superior cows and superior bulls of the same breed are identified and mated. The progeny obtained from such mating are evaluated and superior males and females are identified for further mating. A superior female, in the case of cattle, is the cow that produces more milk per lactation. On the other hand, a superior male is that bull, which gives rise to superior progeny as compared to those of other males. Inbreeding increases homozygosity. Thus inbreeding is necessary if we want to develop a pureline in any animal. Inbreeding exposes harmful recessive genes that are eliminated by selection. It also helps in accumulation of superior genes and elimination of less desirable genes.

But continued inbreeding reduces fertility and even productivity. This is called inbreeding depression. In this condition, the selected animals of the breeding population should be mated with superior animals of the same breed but unrelated to the breeding population. This often helps in restoring fertility and yield.

(c)

i. Karan Swiss and Sunandini are the new breeds of cattle.

ii. White leghorn and New hamshire are the improved breeds of chicken.