

CBSE Class 12 Biology
Sample Paper 05 (2019-20)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

- i. There are a total of 27 questions and five sections in the question paper. All questions are compulsory.
 - ii. Section A contains question numbers 1 to 5, multiple choice questions of one mark each. Section B contains question numbers 6 to 12, short answer type I questions of two marks each. Section C contains question numbers 13 to 21, short answer type II questions of three marks each. Section D contains question number 22 to 24, case-based short answer type questions of three marks each. Section E contains question numbers 25 to 27, long answer type questions of five marks each.
 - iii. There is no overall choice in the question paper. However, internal choices are provided in two questions of one mark, one question of two marks, two questions of three marks and all three questions of five marks. An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.
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Section A

1. Assertion: Each spermatogonium is diploid and contains 46 chromosomes.
Reason: Some spermatogonia, primary spermatocytes complete the meiotic division to form four haploid cells.
 - a. Assertion is incorrect but reason is correct
 - b. Assertion is correct but reason is incorrect
 - c. Both assertion and reason are incorrect
 - d. Both assertion and reason are correct

OR

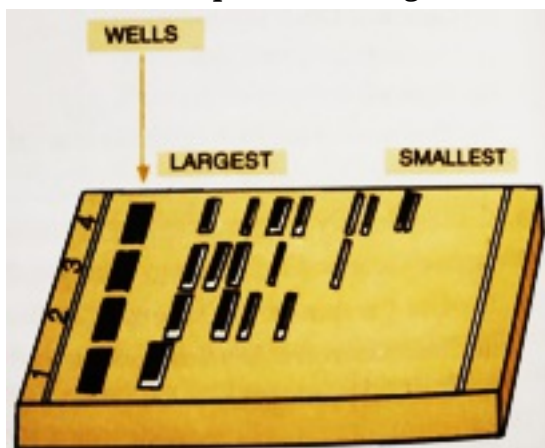
In ET technique embryo is transferred into

- a. Always fallopian tube
 - b. Always uterus
 - c. Fallopian tube or uterus
 - d. Ovary
2. At which stage of HIV infection does one usually show symptoms of AIDS?
- a. Within 15 days of sexual contact with an infected person
 - b. When HIV replicates rapidly in helper T-lymphocytes and damages large number of these
 - c. When the infecting retrovirus enters host cells
 - d. When viral DNA is produced by reverse transcriptase

OR

Cirrhosis of liver is caused by the chronic intake of

- a. Cocaine
 - b. Opium
 - c. Tobacco (Chewing)
 - d. Alcohol
3. In Gel Electrophoresis, fragments are moved from:



-
1. Anode to Cathode
 2. Cathode to Anode
 3. Negative to Positive
 4. Positive to Negative
- a. 1, 4
 - b. 1, 3
 - c. 2, 4
 - d. 2, 3
4. The separation and purification of recombinant protein product is called as
- a. Tissue culture
 - b. Extraction
 - c. Downstream processing
 - d. Hybridisation
5. Biological diversity level that doesn't exist is:
- a. alpha
 - b. beta
 - c. gamma
 - d. delta

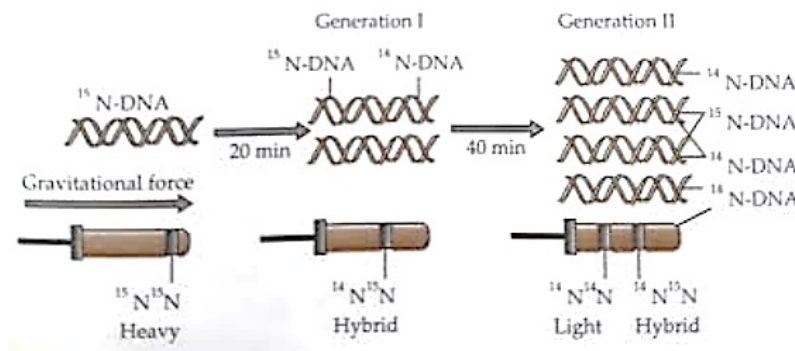
Section B

6. i. Name the organism that reproduces through the following reproductive structures:
- a. Conidia
 - b. Zoospores
- ii. Mention similarity and one difference between these two reproductive units.

OR

Write a short note on pollen allergy.

7. Do you think that reproductive health in our country has improved in the past 50 years? If yes, mention some such areas of improvement
8. Name the type of inheritance in which the phenotypic and genotypic ratio are same. Also give the ratio.
9. Results of the famous experiment given in the figure. Answer the question:



- a. Identify the given experiment.
 - b. Which property of the DNA is proved by this experiment?
10. How is evaluation and testing of the new variety carried out?
 11. Sangeeta has developed a transgenic crop. She wants to grow this crop directly into the field. Will you allow her to do so? What will you suggest her?
 12. Mention four significant services that a healthy forest ecosystem provide.

Section C

13.
 - i. Draw a labelled diagram of LS of a flower to show the growth of pollen tube reaching egg apparatus.
 - ii. Pistil of a flower does not accept pollen from any plant other than its own kind. How does it happen? Explain.
 - iii. What is syngamy?
14. With the help of an example of each explain the following Apomixis, parthenocarpy, polyembryony.

15. What is a criss-cross inheritance? Give its importance.

OR

When a cross is made between a tall plant with yellow seeds (Tt Yy) and tall plant with green seed (Tt yy), what proportion of phenotype in the offspring could be expected to be -

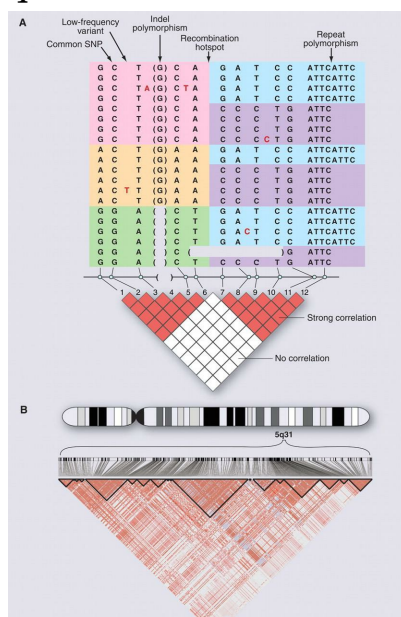
- i. Tall and green
- ii. Dwarf and green

16. Refer to the figure given below and answer the following questions



- i. Identity the process by which Tasmanian wolf came into evolution.
- ii. Define the process identify in (i).
- iii. Apart from marsupials this process was also observed in which other organism?

17. Observe the diagram for genetic mapping of human DNA and answer the following questions:



- i. Explain DNA polymorphism as the basis of genetic mapping of the human

genome.

- ii. State the role of VNTR in DNA fingerprinting.
18. i. What is micropropagation? Why are the plants produced by micropropagation called somaclones?
- ii. Name the techniques by which healthy plants can be recovered from diseased plants.
19. List the disadvantages of insulin obtained from the pancreas of slaughtered cows and pigs.
20. Why are
- (i) alien species invasion and
 - (ii) loss of habitat and fragmentation considered to be the major cause of loss of biodiversity? Explain with the help of one example each.

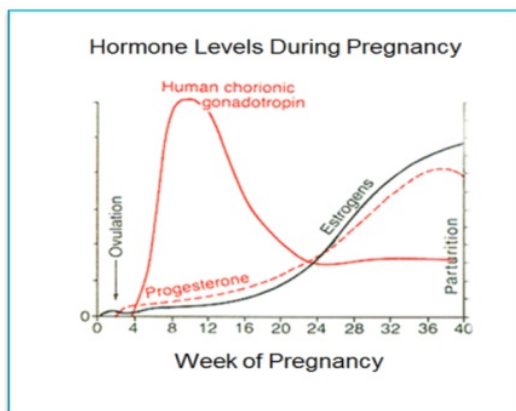
OR

Explain giving reasons why there is greater biodiversity in tropical regions of the Earth.

21. i. How are recombinant vectors created?
- ii. For creating one recombinant vector only one type of restriction endonuclease is required. Give reason

Section D

22. Observe the graph and answer the questions that follow:



- i. Arrange the following hormones in the sequence of their secretion in a pregnant woman.

hCG, LH, FSH, Relaxin

- ii. Mention their source and the function they perform.
- iii. Which hormone is/are detected in a pregnancy test?

23. Observe the following picture of the biogas plant and answer the following questions:



- i. Why are biogas plants mainly located in rural areas?
- ii. Which microbes are employed to produce biogas?
- iii. Who developed the technology of biogas production in India?

24. Observe the picture for wind power (A) and solar energy (B) respectively and answer the following questions:



A



B

- i. The power generation by the above two methods is non-polluting. True/False
- ii. List any two applications of solar energy.
- iii. What is a photovoltaic cell?

Section E

25. What is the inheritance pattern observed in the size of starch grains and seed shape of *Pisum sativum*? Work out the monohybrid cross showing the above traits. How does this pattern of inheritance deviate from that of Mendelian law of dominance?

OR

- i. How are the following formed and involved in DNA packaging in a nucleus of a cell?
 - a. Histone octamer
 - b. Nucleosome
 - c. Chromatin
 - ii. Differentiate between Euchromatin and Heterochromatin.
26. i. State the objective of animal breeding.
- ii. List the importance and limitations of inbreeding. How can the limitations be overcome?
 - iii. Give an example of a new breed each of cattle and poultry.

OR

- a. What are autoimmune diseases?
 - b. Why are autoimmune diseases called degenerative diseases?
 - c. Name the autoimmune disease of body muscles.
 - d. Which types of immunity is provided by T-lymphocytes?
 - e. Which immune cells form humoral immune system?
27. A plastic sack manufacturer in Bengaluru, Ahmed Khan has managed to find an ideal solution to the problem of plastic waste. Explain in five steps the efforts of Ahmed Khan to meet the challenges of solid waste management.

OR

Define decomposition and describe the processes and products of decomposition.

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Solution
Section A

1. (b) Assertion is correct but reason is incorrect

Explanation: Each spermatogonium is a diploid cell and contains 23 pairs of chromosomes. Some spermatogonia, called primary spermatocytes complete the first meiotic division to form two haploid cells. So, assertion is correct but reason is incorrect.

OR

- (c) Fallopian tube or uterus

Explanation: In ET (embryo transfer) technique, in vitro fertilized embryo is transferred into fallopian tube or uterus for further development.

2. (b) When HIV replicates rapidly in helper T-lymphocytes and damages large number of these

Explanation: HIV enters into T -lymphocytes replicates and produces progeny viruses. The progeny viruses released in the blood other helper T-lymphocytes. This is repeated leading to a progressive decrease in the body of the infected person. During this period, the person suffers from bouts of fever, diarrhoea and weight loss. The person starts suffering from an infection. The symptoms of HIV infection does not usually appears in AIDS patients.

OR

- (d) Alcohol

Explanation: Cirrhosis of liver is caused by the chronic intake of alcohol. Regular consumption of alcohol damages the liver cells. Cirrhosis of liver is a serious condition when normal liver tissue is replaced by scar tissue.

3. (d) 2, 3

Explanation: 2, 3

4. (c) Downstream processing

Explanation: Downstream processing is the separation and purification of recombinant protein product. Downstream processing and quality control testing vary for different products.

5. (d) delta

Explanation: Biological diversity level is classified as alpha, beta and gamma. Delta is not a biological diversity level.

The terms alpha, beta, and gamma diversity were all introduced by R. H. Whittaker to describe the spatial component of biodiversity. Imagine that you have a landscape containing of a number of separate sites and habitats. Alpha diversity is just the diversity of each site (local species pool). Beta diversity represents the differences in species composition among sites. Gamma diversity is the diversity of the entire landscape (regional species pool).

Section B

6. i. a. Conidia - *Penicillium*
b. Zoospore - *Chlamydomonas*
ii. The similarity between the zoospores and conidia is that both of them are asexual, have been reproduced by large cells. The zoospores are produced by algae while the conidia are produced by fungi.

OR

Some people are sensitive to the pollen proteins and develop an allergy involving respiratory disorders like asthma, bronchitis, rhinitis, etc. The bronchial allergy is also called hay fever. The fever or allergy is caused in India by pollen of many plants such as *Chenopodium album*, *Cynodon dactylon*, *Amaranthus spinosus*, *Ricinus communis*, *Parthenium* etc.

7. Yes, the programmes like family planning and reproductive and child health care have been successfully launched. Now more people are aware about the advantages of small family and are accepting two children norm. Some such areas of improvement are massive child immunization, increasing use of contraceptives, family planning etc.
8. **Incomplete dominance** is a form of intermediate inheritance in which one allele for a specific trait is not completely expressed over its paired allele.

A cross of two F1 hybrids, heterozygous for a single trait that displays incomplete dominance is predicted to give a **1:2:1** ratio among both the genotypes and phenotypes of the offspring

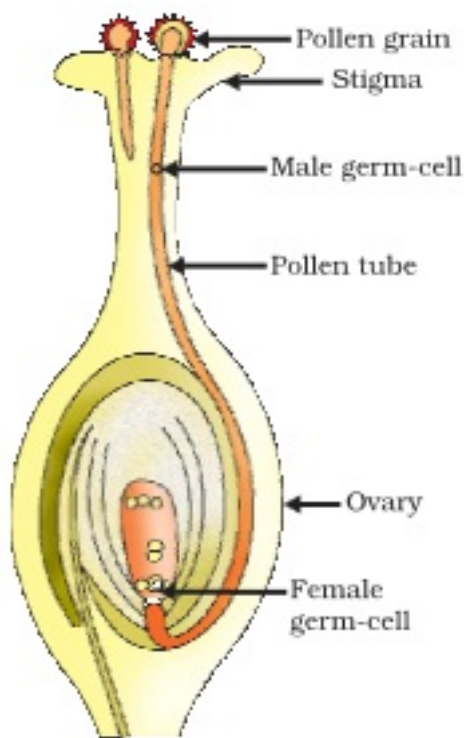
9. a. The given diagram is representing "Messelson and Stahl's experiment". It is proven that DNA replicates semi conservatively.
b. The strands of DNA are of intermediate density. The double-stranded DNA is $\frac{1}{2}$ Heavy and $\frac{1}{2}$ Light.
10. The evaluation is done by growing new varieties in the research field under ideal temperature, fertilizer and irrigation conditions. After evaluation, the testing is done in the farmer's fields for three growing seasons at several locations in the country, representing all the agroclimatic zones.
11. No, as GMO may pose some threat to environment or living organism. I will ask her to approach GEAC as GEAC is responsible for approval of proposals relating to release of genetically engineered organisms and products into the environment including experimental field trials.

Values

- Sense of responsibility.
 - Understanding.
12. Ecosystem services are the products of ecosystem processes. Healthy forest ecosystem provides the following ecosystem services:
 - Purification of air and water
 - Cycling of nutrients
 - Generation of fertile soil
 - Provision of habitat to wildlife

Section C

13. i.



- ii. Pollen-pistil interaction is mediated by the interaction between chemical components secreted by pollen and those of pistil. So, if the pollen is not of its kind or compatible with stigma, it does not germinate or if germinated, pollen tube cannot grow in the style and the reaction is called pollen-pistil interaction.
- iii. The fusion of a male gamete with a female gamete (egg) to form a zygote is called syngamy.

14. **Apomixis** -The phenomenon in which seeds are produced without fertilization is called apomixis or agamospermy, e.g. grass.

Parthenocarpy -It is a commercially important process in which seedless fruit is formed without fertilization, e.g. banana.

Polyembryony -The occurrence of more than one an embryo in a seed is known as polyembryony, e.g. orange.

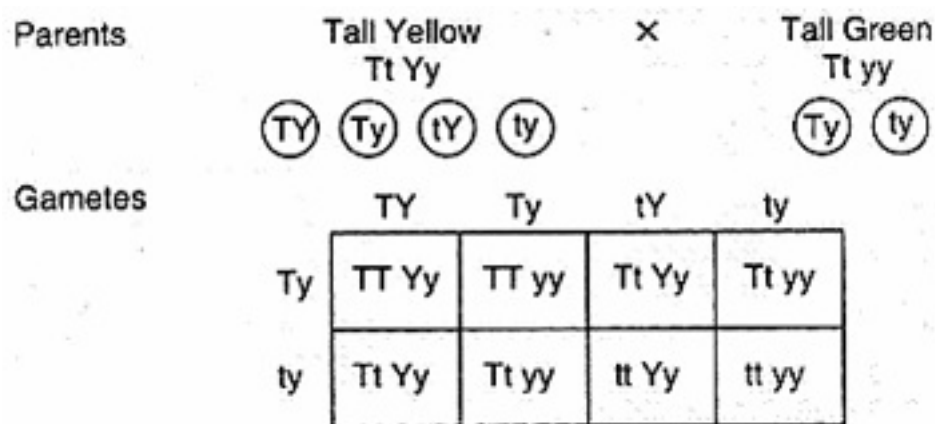
15. **Criss-cross Inheritance:** It was first studied by Morgan (1910) in case of eye colour in *Drosophila*. It is a type of sex-linked inheritance where a parent passes the traits to the grandchild of the same sex through offspring of the opposite sex, that is, the father passes the traits to grandson through his daughter (diagynic) while the mother transfer traits to her granddaughter through her son (dia-Andric). Criss-cross inheritance is applicable to most sex-linked disorders in humans, e.g., red-green

colour blindness, haemophilia, etc.

Importance:

- i. Discovery of criss-cross inheritance proved that genes are located in the chromosomes.
- ii. Any trait that shows criss-cross inheritance is located on the sex chromosome.
- iii. Knowledge of criss-cross in knowing the past, present and future inheritance is useful transmission of sex-linked disorders.

OR



Phenotypic ratio:

Tall yellow : tall green : Dwarf yellow : dwarf green

3 : 3 : 1 : 1

Tall and green = 3

Dwarf and green = 1.

16.
 - i. Adaptive radiation
 - ii. It is an example of convergent evolution. Despite the temporal and geographical separation, marsupials in Australia and placental mammals in North America have produced varieties of species living in similar habitat with similar ways of living.
 - iii. Darwin Finches.
17.
 - i. Polymorphism is inherited from parents to children. So, it is useful for identification and paternity testing. It arises due to the mutations and plays an important role in speciation and evolution. Thus, DNA polymorphism exhibited by certain repetitive DNA sequences and it is the basis to construct genetic and

physical maps of the genome which are used in the human genome project.

- ii. Variable Number of Tandem Repeats (VNTRs) belongs to a class of satellite DNA called a minisatellite. VNTRs are used as probes in DNA fingerprinting.

- 18. i. The method of producing thousands of plants through tissue culture is called micropropagation. The plants produced through micropropagation are genetically identical to the original plant from which they are grown, so they are called as somaclones.

Advantages of micropropagation are as follows:

- a. More number of plants can be produced in a short time.
 - b. Disease-free plants can be developed from diseased plants.
 - c. Seedless plants can be multiplied
 - ii. Healthy plants can be recovered from diseased plants by meristem culture because meristems are free from viruses in diseased plants.
- 19. i. Insulin is a hormone is produced in very little amounts in the body. Hence, a large number of animals need to be sacrificed for obtaining small quantities of This makes the cost of insulin very high- Demand being many folds higher than supply.
 - ii. Slaughtering of animals is also not ethical.
 - iii. There is the potential of the immune response in humans against the administered insulin which is derived from animals.
 - iv. There is a possibility of slaughtered animals being infested with some infectious microorganism which may contaminate the insulin.

- 20. (i) The alien species become invasive and cause a decline or extinction of indigenous species.

e.g. the Nile Perch introduced into Lake Victoria in east Africa led to the extinction of more than 200 species of Cichlid fish in the lake.

(ii) Habitat loss and fragmentation deprive the organisms of their natural home and hence leads to their extinction.

When large habitats are broken up into small fragments, mammals and birds which require large territories and certain animals with migratory habits are seriously affected. This leads to decline in their population.

e.g. When the Amazon forest is cut and cleared for conversion into grasslands, many species are affected due to destruction of their habitat.

OR

Ecologists and evolutionary biologists have proposed three hypotheses to explain the difference in the biodiversity of tropics and temperate forests. They are:

- i. Speciation, in general, is a function of time, while temperate regions were subjected to frequent glaciations in the past, the tropics have remained undisturbed and hence had evolved more species diversity.
 - ii. As compared to temperate regions, tropical environments are less seasonal, relatively more stable, constant and predictable. Such constant environments have promoted niche specialisation and greater species diversity.
 - iii. There is more input of solar radiations available in the tropical regions, increases available resources and this contributes directly to more productivity, population sizes and indirectly to greater species diversity.
21. i. The vector DNA is cut at a particular restriction site using a restriction enzyme (to cut the desired DNA segment). The alien DNA is then linked with the plasmid DNA using an enzyme called ligase to form the recombinant vector.
- ii. A restriction enzyme recognises and cuts the DNA at a particular sequence, called recognition site. If more than one restriction enzymes are present, they will generate several segments and will complicate gene cloning.

Section D

22. i. The sequence of secretion of the given hormones in a pregnant woman is FSH → LH → hCG → Relaxin
- ii.

Hormone	Source	Function
FSH	Anterior pituitary lobe	Stimulates the growth of ovarian follicles in the ovary.
LH	Anterior pituitary lobe	It triggers ovulation.
hCG	Placenta	It stimulates the corpus luteum to secrete progesterone.
Relaxin	Placenta	It facilitates parturition by softening the connective tissue of symphysis pubica.

-
- iii. hCG hormone is detected in a pregnancy test.
23.
 - i. Because the cattle dung is available in plenty in the rural areas that's why biogas plants mainly located in rural areas.
 - ii. Methanogens.
 - iii. Khadi and Village Industries Commission (KVIC) and Indian Agricultural Research Institute (IARI) developed the technology of biogas production in India.
24.
 - i. True. Solar energy and wind power are non-polluting.
 - ii. Two applications of solar energy.
 - a. Solar battery driven cars.
 - b. Solar cookers and heaters have been developed.
 - iii. Photovoltaic cell is that panel which transforms solar radiant energy into electrical energy.

Section E

25. ***Pisum sativum* shows Pleiotropy:** It is the phenomenon in which a single gene control more than one phenotypic character in an organism. It is said to be pleiotropic because in it a single gene control the amount of starch formation and size of the starch grain.

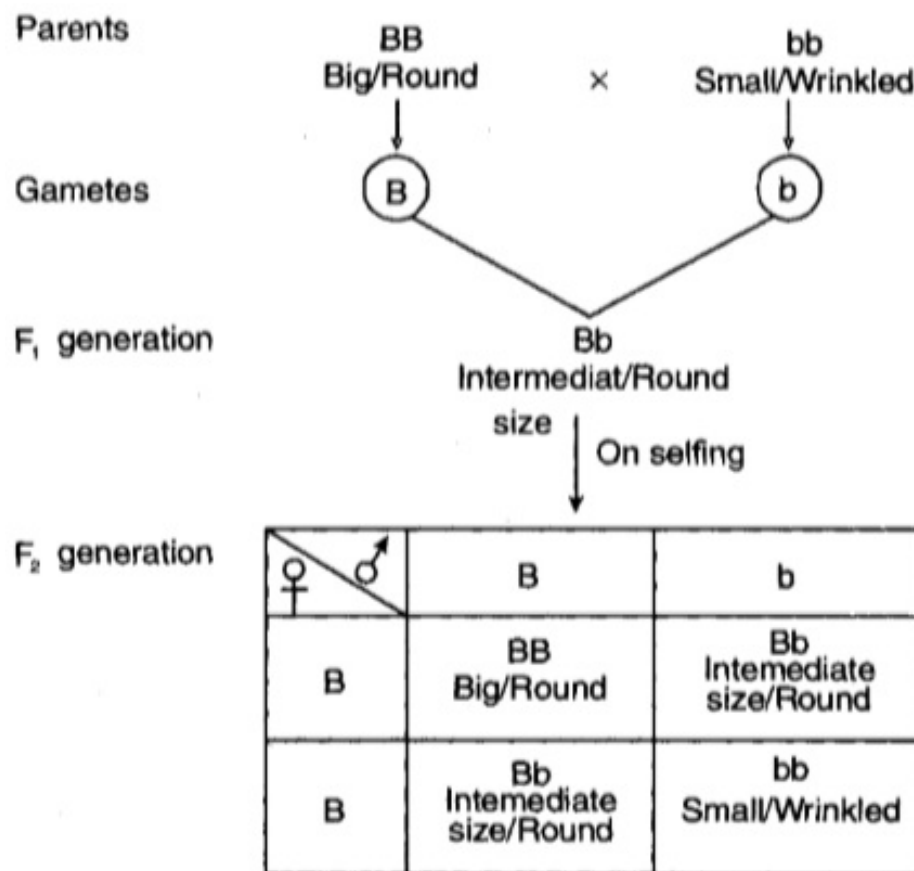
For example, in *Pisum sativum* starch synthesis is controlled by a single gene. It has two alleles B and b. Allele B in the homozygous condition (BB) produces a large number of starch grains and rounded seeds. Allele b in homozygous condition (bb) produces smaller starch grains and wrinkled seeds. The heterozygotes (Bb) produce round seeds and the starch grains, are of intermediate size. This monohybrid cross shows that allele B is dominant over allele b as the Bb heterozygous have round seeds. But if the trait of starch grain, is considered, the heterozygote Bb have starch grains of intermediate size, and not the size that of BB seeds. So if the starch grain size is considered as a phenotype, then the alleles show incomplete dominance. If both the traits are considered together, then gene B can be regarded as a pleiotropic gene as it is expressing two characters i.e. size of starch grain and seed shape. Its is seen that pleiotropic effect is shown by *Pisum sativum* due to interrelationship between different metabolic pathways that are responsible for phenotypic characters.

The pattern of inheritance is different from that of Mendelian inheritance as in the F1

hybrid progeny, the starch grains are of intermediate size and not of the size (large size) of the dominant parent as shown in Mendel's Monohybrid cross. Thus there is incomplete dominance, with regard to the size of starch grains.

In Mendelian inheritance, one allele over other allele is completely dominant over the recessive allele and one gene controls the inheritance of one character.

But in pleiotropic condition, the pattern of inheritance is different as a single gene (gene product) is controlling two characters.



A cross showing pleiotropic effect in *Pisum sativum*.

OR

- i. a. **Histone Octamer** Histones are the proteins that are rich in basic amino acids, i.e. lysine and arginine. Both these amino acids carry positive charges in their side chains.

A histone octamer is formed by the organisation of two molecules each of H₂A, H₂B, H₃ and H₄ histones so as to make a unit of 8 molecules. It helps to package

DNA into the nucleosome.

b. **Nucleosome** The negatively charged DNA is wrapped around the positively charged histone octamer, forming a structure known as a nucleosome. It forms the fundamental repeating units of eukaryotic chromatin. It is used to pack the large eukaryotic genome into the nucleus.

c. **Chromatin** One nucleosome contains 200 base pairs of DNA helix, approximately. Nucleosomes are the repeating unit of chromatin, which are thread-like stained (coloured) bodies present in the nucleus.

The nucleosomes in chromatin look like 'beads-on-string' when observed under an electron microscope.

The chromatin is further packed to form a solenoid structure of 30 nm diameter and further supercoiling tends to form a looped structure called chromatin fibre and then chromatid. This further coils and condense at metaphase stage to form the chromosomes.

ii. Differences between euchromatin and heterochromatin

Euchromatin	Heterochromatin
It is lightly stained region.	It is darkly stained region of the chromatin (chromosome).
It is loosely coiled region and thus, has less DNA.	It is the compactly coiled region and thus, has more DNA.
It is transcriptionally active and is transcribed into mRNA.	It is transcriptionally inert and cannot be transcribed into mRNA due to very tight coiling.

26. i. The main objective of animal breeding is to increase the yield of animals and improve the desirable and superior qualities in both the animals and their products.

ii. **Importance of Inbreeding:**

a. It increases homozygosity and evolves a pure line.

b. Accumulation of superior genes and the elimination of less desirable genes by selection.

Limitations of Inbreeding: The continued inbreeding in animals for subsequent generations reduces their fertility and productivity, resulting in a condition called inbreeding depression.

The inbreeding depression can be overcome by a single outcross, i.e. mating between animals of the same breed have no common ancestors up to 4-6 generations.

- iii. An example, of a new breed of cattle, is Hisardale and that of poultry is New Hampshire.

OR

- a. Disorders in which the immune system of an individual starts rejecting its own body cells are called autoimmune diseases.
- b. In autoimmune diseases, certain body cells undergo degeneration that's why these are called as degenerative diseases.
- c. Myasthenia gravis is an autoimmune disease of body muscles.
- d. Cell-mediated immunity is provided by T-lymphocytes.
- e. B-lymphocytes cells form the humoral immune system.

27. Khan's efforts for solid waste management can be summarised in the following points:

- He has developed **polyblend** which is a fine powder of recycled modified plastic.
- He mixes polyblend with bitumen and then uses it to lay roads (in collaboration with R V engineering college and Bangalore city corporation).
- It enhanced water repellent property of bitumen thus increasing the road life.
- Khan offered a price to rag pickers which enhanced their income and improved their livelihood.
- Using his technique, more than 40 kms of road in Bangalore has already been laid by year 2002.

Thus solid waste management was achieved by removal and proper disposal of plastic waste from the city.

OR

Decomposition is the physical and chemical breakdown of complex organic remains into inorganic raw materials for recycling. It is carried out by decomposers.

Process: Three types of processes occur during decomposition

- Fragmentation of detritus
- Catabolism
- Leaching

(1) Fragmentation of detritus: It is the break down of dead plants and animals into smaller particles.

(2) Catabolism: It involves secretion of digestive enzymes by decomposers on the detritus. It changes insoluble complex organic substances into simple and soluble organic compounds and inorganic substances.

(3) Leaching : Soluble simpler substances formed during decomposition along with percolation water pass down to deeper layers of soil.

Products: Decomposition process gives rise to two products

(i) Humus (ii) Inorganic nutrients

Humus is a dark coloured amorphous substances and acts as reservoir of nutrients, maintenance of soil moisture and aeration