CBSE
Class XII Biology

Time: 3 hrs **Total Marks: 70**

General Instructions:

1. All questions are compulsory.
2. This question paper consists of five sections A, B, C, D and E. Section **A** contains **5** questions of **one** mark each, Section **B** is of **5** questions of **two** marks each, Section **C** is of **12** questions of **three** marks each, Section **D** is of **1** question of **four** marks and Section **E** is of **3** questions of **five** marks each.
3. There is no overall choice. However, an internal choice has been provided in **one** question of **2** marks, **one** question of **3** marks and all the **three** questions of **5** marks weightage. A student has to attempt only one of the alternatives in such questions.
4. Wherever necessary, the diagrams drawn should be neat and properly labelled.

Section A

1. An anther with malfunctioning tapetum often fails to produce viable male gametophytes. Give any one reason. [1]

2. Why are plasmids largely used as vectors? [1]

3. How is golden rice genetically different from normal rice? [1]

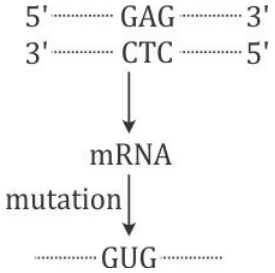
4. Arrange the following in their hierarchy of levels:
Community, population, ecosystem, organ system, biosphere [1]

5. Name two species which have become extinct due to the overexploitation by humans. [1]

Section B

6. If one sperm is sufficient to fertilise the ovum, then why does human ejaculate carry a number of sperms? [2]

7. From the following diagram of molecular mechanism of mutations, identify the type of mutation. [2]



Which disease is represented by such a mutation?

8. What is a test cross? How does it differ from a reciprocal cross? [2]

9. Expand PCR. List its two uses. [2]

10. How is diapause different from hibernation? [2]

OR

Differentiate between a grazing food chain and a detritus food chain.

Section C

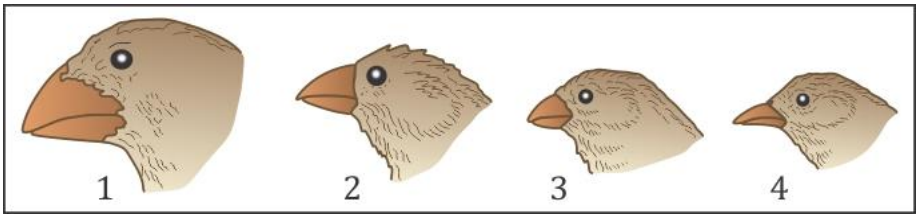
11. Why is cross-pollination considered superior to self-pollination? [3]

12. Name the hormones involved in regulation of spermatogenesis. [3]

13. A length of DNA helix is far greater than the dimension of a typical nucleus. How is long DNA polymer packaged in a cell? [3]

14. Snapdragon shows incomplete dominance for flower colour. Work out the progeny from a cross between plants with pink flowers and state their phenotype. [3]

15.



(a) Write your observation on the variations seen in the Darwin's finches shown above.

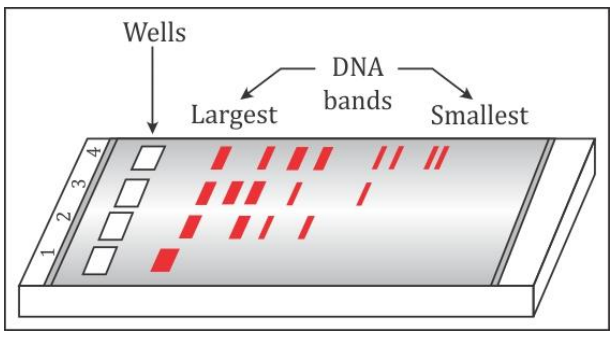
(b) How did Darwin explain the existence of different varieties of finches on Galapagos Islands? [3]

16. How does moderate fever help a person in combating infections? What is to be done to bring down high body temperature? [3]

17. What are the new methods used for increasing fish production? [3]

18. Briefly describe the three critical research areas of biotechnology. [3]

19.



(a) What does this diagram depict?
(b) What is meant by 'Largest' and 'Smallest' in the picture?
(c) Name the compound used to visualise them.
(d) Define elution. [3]

20. When does the population growth curve assume the 'J' and sigmoid 'S' shapes? [3]

21. Give an account of factors affecting the rate of decomposition. [3]

OR

List three important characteristics of a population and explain.

22. [3]

(a) Why do farmers prefer biofertilisers to chemical fertilisers these days? Explain.
(b) How does *Anabaena* and mycorrhiza act as biofertilisers?

Section D

23. Grandfather told his grandson Arun that many years ago the villagers in Uttarakhand started a movement to save the trees of the Himalayas by hugging the trees whenever contractors came to cut them [4]

This movement was effective in saving our forest wealth.

Read the above passage and answer the following questions:

(i) What is the name of given to this movement?

(ii) Where was this movement originated?

(iii) How are trees important for maintaining the ecosystem?

(iv) What value was displayed by villagers?

Section E

24.

(a) Describe the events of spermatogenesis with the help of a schematic representation.

(b) Write two differences between spermatogenesis and oogenesis.

[5]

OR

Name the various types of foetal membranes and briefly explain each of them.

25. What will happen: [5]

(i) When complete sets of chromosomes are added to a diploid genome?

(ii) When individual chromosomes are added to or deleted from the diploid genome?

(iii) When a part of the chromosome is lost?

(iv) When a part of the chromosome breaks and attaches to another non-homologous chromosome?

(v) When a part of the chromosome breaks and attaches to its homologue?

OR

(a) How does a chromosomal disorder differ from a Mendelian disorder?

(b) Name any two chromosomal aberration-associated disorders.

(c) List the characteristics of the disorders mentioned above which help in their diagnosis.

26.

(a) State the objectives of animal breeding.

(b) List the importance and limitations of inbreeding. How can the limitations be overcome?

(c) Give an example of a new breed each of cattle and poultry. [5]

OR

Explain the process of replication of a retrovirus after it gains entry into the human body.

CBSE

Class X Biology

Solution

Time: 3 hrs **Total Marks: 70**

Section A

1. **Ans**
   An anther with a malfunctioning tapetum often fails to produce viable gametophytes because the tapetum provides nutritive materials to the dividing microsporocytes.

2. **Ans**
   Plasmids are largely used as vectors because they can move from one cell to another and make several copies of themselves without affecting the bacterium.

3. **Ans**
   Golden rice is a transgenic variety of rice (*Oryza sativa*) containing the 'beta carotene' gene which is a principal source of vitamin A.

4. **Ans**
   Organ system, Population, Community, Ecosystem, Biosphere

5. **Ans**
   Steller's sea cow and passenger pigeon

Section B

6. Ans

The human ejaculate carries sufficient number of sperms to increase the probability of fertilisation. These sperms die before they reach the vicinity of the ovum, and only one sperm can penetrate the ovum.

7. Ans

Point mutation (single-based substitution) converts the GAG codon to GUG. Hence, glutamic acid in the original code is changed to valine after mutation. This is an autosomal recessive trait in humans. Sickle cell anaemia is caused by this mutation.

8. Ans

A test cross is a cross between the F1 hybrid and recessive parent. It confirms the purity of the F1 hybrid whether it is homozygous or heterozygous.

A reciprocal cross is a second cross involving the same strains but carried by sexes opposite to those in the first cross. This can distinguish between nuclear, chromosomal and sex-linked inheritance.

9. Ans

PCR stands for polymerase chain reaction.

Uses:

(i) PCR is used in DNA fingerprinting.

(ii) It is used to detect prenatal genetic disease.

10. Ans

Diapause is a stage of suspended development. Many zooplankton species in lakes and ponds undergo this suspended development under unfavourable conditions. Hibernation is the winter sleep of an animal where it suspends its metabolic activities or maintains a low metabolic rate.

OR

Grazing Food Chain	Detritus Food Chain
(i) First tropic level organisms are detritivores and decomposers. (ii) It is based on energy from the Sun.	(i) First tropic level organisms are producers. (ii) It is based on energy present in the detritus.

Section C

11. Ans

It is considered superior because

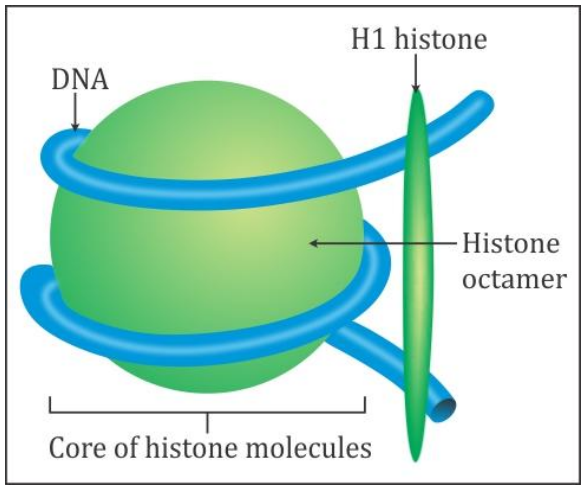
(i) It ensures new genetic recombination and variability.
(ii) It produces new and improved offspring.
(iii) The defective and undesired characters are also removed by cross-pollination.
(iv) It increases the adaptability of the offspring.
(v) Plants produced by cross-pollination are more resistant to diseases.
(vi) Plants formed by this method are high yielding.

12. Ans

At the age of puberty, a hypothalamic hormone called gonadotropin-releasing hormone (GnRH) is secreted which acts at the anterior pituitary gland and stimulates the secretion of two gonadotropins—luteinising hormone (LH) and follicle-stimulating hormone (FSH). LH acts at the Leydig cells and stimulates synthesis and secretion of androgens. Androgens stimulate the process of spermatogenesis. FSH acts on the Sertoli cells and stimulates the secretion of factors which help in the process of spermiogenesis.

13. Ans

In prokaryotes (*E. coli*), there is no definite nucleus but the DNA is not scattered throughout the cell. DNA is negatively charged which is held with some proteins (positively charged) in a region called nucleoid. The DNA in the nucleoid is organised in large loops held by proteins. In eukaryotes, there are positively charged proteins called histones. It carries basic amino acid residues like lysine and arginine which have positive charges in their side chains. Histones are organised to form a unit of eight molecules called the histone octamer. The negatively charged DNA wraps around the positively charged histone octamer to form a structure called a nucleosome. Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin. The nucleosomes in chromatin are seen as beads-on-string structure under electron microscope. These are further packaged to form chromatin fibres and chromosomes. The packaging of chromatin at higher level requires an additional set of proteins called non-histone chromosomal (NHC) protein.



14. Ans

Parents ... Pink flowers × Pink flowers
Genes ... Rr Rr
Gametes ... R, r R, r
Progeny:

	R	r
R	RR Red	Rr Pink
r	Rr Pink	rr White

Result = Red = 1; Pink 2;White = 1
Ratio = 1:2:1

15. Ans

(a) These were small birds observed in the Galapagos Islands. There were many varieties on the same island and showed differences among themselves in shape and size of beaks depending on their food habits.

(b) Darwin reasoned that after originating from a common ancestral seed-eating stock, the finches must have radiated to different geographical areas and gone through adaptive changes, especially in the type of beak (adaptive radiation). Living in isolation for long, the new kinds of finches emerged which could function and survive in new habitats.

16. Ans

Fever is caused by the toxin released by pathogens or pyrogens, compounds released by WBCs to regulate the temperature of the body. Fever is a natural defence mechanism because it stimulates the phagocytes and inhibits the growth of pathogens. Very high fever is risky, and it must be lowered by giving antipyretics and by applying cold treatment.

17. Ans

(i) Fish production can be increased by developing indoor hatcheries, nurseries and rearing and stocking methods. Fish eggs are introduced into nurseries where young ones hatched from the eggs are fed, nursed and harvested when fully grown.

(ii) Aquaculture techniques of induced breeding by the administration of pituitary hormones have helped seed fish in the pure form.

(iii) These days, agriculturists culture fish in their paddy fields. This is called paddy cum pisciculture.

18. Ans

Critical research areas of biotechnology:

(i) Catalyst: Providing a microbe or pure enzyme to be used as a catalyst.

(ii) Optimum conditions: Genetic engineering to provide optimal conditions for a catalyst to act.

(iii) Downstream processing: Developing downstream processing technologies to purify the protein or an organic compound.

19. Ans

(a) Gel electrophoresis

(b) DNA fragments/bands

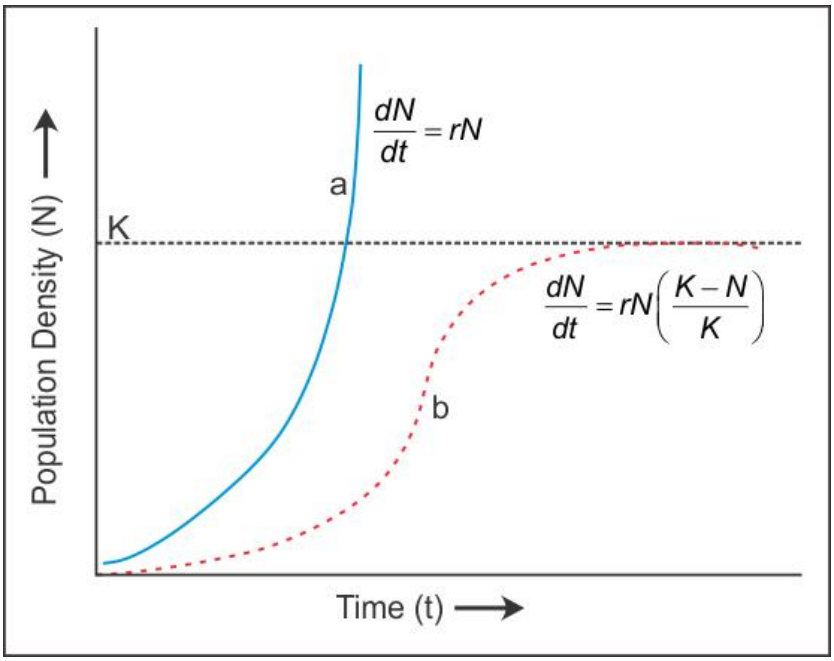
(c) Ethidium bromide

(d) The separated bands of DNA are cut out from agarose gel and DNA is extracted from gel piece

20. Ans

The 'J' shaped growth (exponential) curve is obtained when the environment resistance does not exist in the natural predator-free environment. The presence of plenty of food in the environment causes the organisms to grow exponentially, and thus, no zero population growth is attained.

The 'S' shaped (sigmoid or logistic) growth curve is obtained when environmental resistance exists in nature. Because of the presence of limited resources, the population first grows slowly and then exponentially until the individuals become so numerous. Then, the multiplication is checked by the factors of environmental resistance (limited resources) and population growth declines until zero population growth is obtained.



21. Ans

Factors affecting the rate of decomposition:

(i) Temperature: Detritus decomposes very rapidly within a few weeks or months in a climate characterised by higher temperature more than 25°C and moist conditions.

Low temperature less than 10°C sharply reduces the decomposition rate even if moisture is in plenty.

(ii) Soil moisture: Decomposition rate is slow under prolonged soil dryness even if the temperature remains high. High soil moisture fastens the decomposition rate.

(ii) pH: Neutral and slightly alkaline soils are rich in detritivores, earthworms and decomposer microbes. Acidity decreases the number of detritivores and

earthworms. Decomposer microbes occur in slightly acidic soil, but their number decreases with the rise in acidity.

OR

Characteristics of a population:

(i) Density: It is expressed as the total number of individuals per unit area or volume at a given time. The size of the population is determined by the available resources such as nutrients and water at a given time and other group properties such as natality, mortality and age structure.

(ii) Natality: It is the increase in the number of individuals in a population under given environmental conditions. Birth, hatching, germination and even vegetative propagation cause an increase in the number of individuals.

(iii) Mortality: The loss of individuals due to death in a population under given environmental conditions is called mortality.

22. Ans

(a) Chemical fertilisers are very expensive and contribute significantly to pollution. They also cause eutrophication and change the nature of soil. To avoid these, the farmers are enormously using biofertilisers which enrich the nutrient quality of soil. They do not pollute the environment and are specific in their action.

(b) Anabaena is a cyanobacterium which lives in the cavities of Azolla leaves. When it is grown in paddy fields, it serves as an important biofertiliser as it can fix atmospheric nitrogen.

Mycorrhiza is the symbiotic association of fungal hyphae and the roots of higher plants. The fungal hyphae absorb phosphorus from the soil and pass it to the plant.

Section D

23. Ans

(i) Chipko movement.

(ii) This movement originated in a remote village called 'Reni' in Garhwal, high up in the Himalayas in early 1970s.

(iii) Trees are an important component of the forest ecosystem as they are producers, play an important role in the water cycle and prevent soil erosion.

(iv) Villagers wanted to protect the overall environment by checking natural calamities such as flood and drought, and maintaining harmony between different components of the ecosystem.

Section E

24. Ans

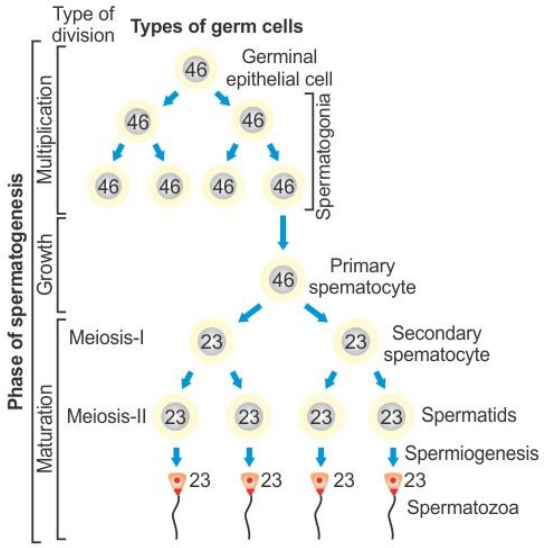
(a) Spermatogenesis is the process where sperm mother cells in the seminiferous tubules of the testes change into haploid spermatozoans. It occurs in the seminiferous tubules of the testes in males.

Various events which take place during spermatogenesis:

i. Multiplicative phase: During this phase, the sperm mother cells are differentiated from the germinal epithelium of the seminiferous tubules of the testes. They divide repeatedly by a number of mitotic divisions to form several daughter cells called spermatogonia.

ii. Growth phase: During this phase, the diploid spermatogonia undergo the process of spermatocytogenesis where they derive nourishment from the nursing cells. They grow and increase in size because of accumulation of nutritive material. Each spermatogonium is called primary spermatocyte bearing a diploid number of chromosomes.

iii. Maturation phase: During this phase, the primary spermatocytes undergo two maturation divisions. The first meiotic division differentiates the primary spermatocyte into two haploid secondary spermatocytes. The second meiosis differentiates each secondary spermatocyte into two spermatids. Thus, four haploid spermatids are formed by each spermatocyte which later gets transformed into flagellated sperms by the process of spermiogenesis.



(b)

Spermatogenesis	Oogenesis
(i) It takes place in the seminiferous tubules of the testes.	(i) It takes place in the follicle cells of ovaries.
(ii) Each primary spermatocyte divides	(ii) Each primary oocyte divides by

by meiosis and forms 4 haploid spermatozoans.	meiosis and forms only one haploid ovum.

OR

Foetal membranes: The developing foetus in the uterus of the mother forms four membranes and these are called foetal membranes. These include chorion, amnion, allantois and yolk sac.

(i) Chorion: It consists of the outer ectoderm and the inner mesoderm. This layer forms the placental villi and completely envelops the foetus to provide protection.

(ii) Amnion: It consists of the outer mesoderm and the inner ectoderm. A space is formed between the amnion and the foetus and is called the amniotic cavity. This cavity gets filled with a clear watery fluid secreted by the foetus and the membrane, an amniotic fluid. This fluid provides protection to the developing foetus against desiccation, mechanical injury and shock.

(iii) Allantois: It is a sac-like structure consisting of the inner endoderm and the outer mesoderm. It originates from the primitive gut of an embryo near the yolk sac. It supplies blood vessels to the placental villi.

(iv) Yolk sac: It is considered vestigial in human beings. It consists of the inner endoderm and outer mesoderm. In macrolecithal eggs of birds, the vitelline arteries and veins connect the yolk sac with the heart of an embryo. The enzymes of the yolk sac digest the yolk into a soluble form. The vitelline vein carries these soluble forms of the yolk to the heart from where these are circulated to all parts of the developing embryo.

25. Ans

(i) Euploidy will occur. Wheat is an example of polyploidy (hexaploid) with 42 chromosomes (6 times multiple of normal haploid, N = 7).

(ii) Aneuploidy will occur. It may be trisomic when a diploid organism bears one chromosome extra (2N + 1) or monosomic when the diploid organism loses one chromosome (2N − 1). Down's syndrome is the best known example of aneuploidy.

(iii) Deletion. Cri-du chat syndrome.

(iv) Translocation will occur. In certain leukaemia, such as chronic myeloid leukaemia (CML), the malignant cells have the chromosome 22 shortened due to translocation of a piece of its long arm.

(v) Inversion will occur. It produces unbalanced meiotic products, thus leading to sterility.

OR

(a)

Chromosomal disorder	Mendelian disorder
i. These genetic disorders are caused by the absence or excess or abnormal arrangement of one or more chromosomes. ii. These are non-heritable and pedigree analysis of a family does not help in tracing the pattern of inheritance of such chromosomal disorders.	i. These disorders are determined by mutations in single genes. ii. They are transmitted to offspring according to Mendelian principles. The pattern of inheritance of such Mendelian disorders can be traced in a family by pedigree analysis.

(b) Down's syndrome and Turner's syndrome.

(c) Symptoms of Down's syndrome:

(i) Mental retardation
(ii) Short statured with small round face and broad forehead
(iii) Partially open mouth with protruding furrowed tongue
(iv) Flat hands and stubby fingers

Symptoms of Turner's syndrome:

(i) Such persons are sterile females who have rudimentary ovaries.
(ii) Undeveloped breasts
(iii) Small uterus
(iv) Puffy fingers and short stature

26. Ans

(a) Objectives of animal breeding:

(i) Improved growth rate
(ii) Increased production of milk, meat, egg and wool
(iii) Superior quality of milk, meat, eggs and wool
(iv) Improved resistance to various diseases
(v) Increased productive life
(vi) Increased or, at least, acceptable reproduction rate

(b) When breeding is between animals of the same breed for 4–6 generations, it is called inbreeding.

Importance of inbreeding:

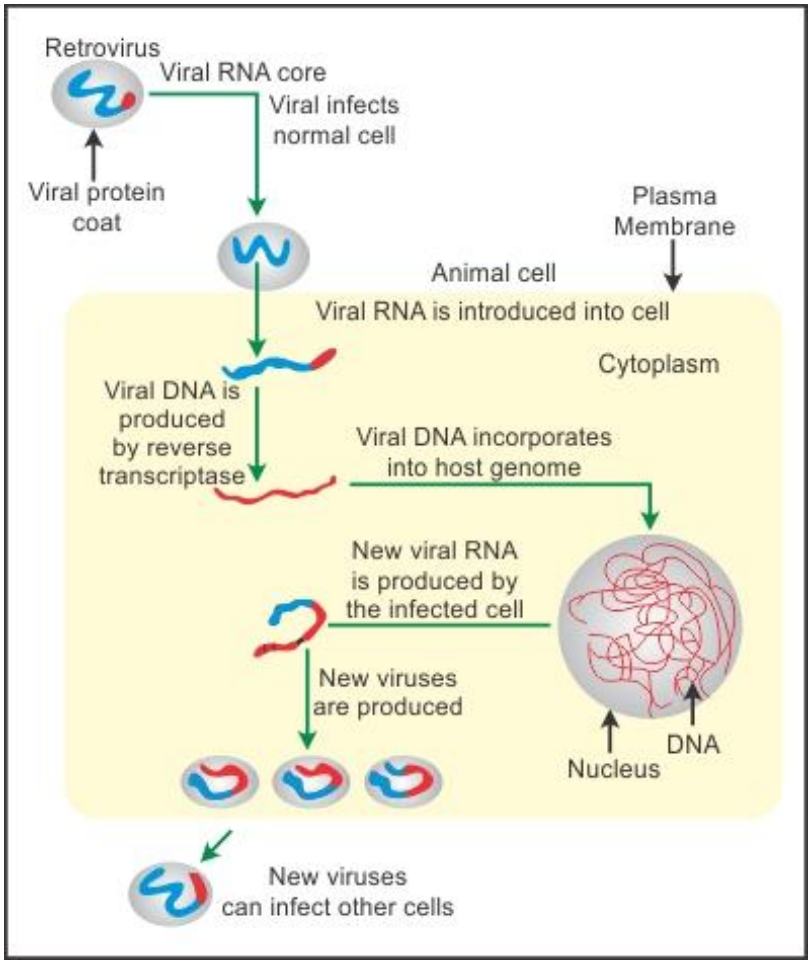
(i) It helps in the accumulation of superior genes and the elimination of undesirable genes.
(ii) It develops the homozygous pureline in an animal; thus, it increases homozygosity to evolve a pureline in any animal.
(iii) It exposes harmful recessive genes for undesirable characters which are eliminated by selection.

Limitation:
Continued inbreeding reduces fertility and even productivity. This is called inbreeding depression.

(c)
(i) Karan Swiss and Sunandini are new breeds of cattle.
(ii) White Leghorn and New Hampshire are improved breeds of chicken.

OR

HIV is a retrovirus which has RNA genomes, and it replicates via DNA copies. On infection, the virus enters the macrophages where the viral RNA genome is converted to a viral DNA copy with the help of the enzyme reverse transcriptase. This viral DNA copy of HIV is inserted into human chromosomes and replicates with the cell DNA.


Retrovirus
Viral RNA core
Viral infects
normal cell
Viral protein
coat
Plasma
Membrane
Animal cell
Viral RNA is introduced into cell
Cytoplasm
Viral DNA is
produced
by reverse
transcriptase
Viral DNA incorporates
into host genome
New viral RNA
is produced by
the infected cell
New viruses
are produced
Nucleus
DNA
New viruses
can infect other cells