

ISC Solved Paper 2020

Biology

Class-XII

(Maximum Marks : 70)

(Time allowed : Three hours)

This paper comprises **TWO PARTS** – Part I and Part II.

Answer **all** questions.

Part I contains **one** question of 20 marks having four subparts.

Part II consists of Sections A, B and C.

Section A contains **seven** questions of **two** marks each

Section B contains **seven** questions of **three** marks each, and

Section C contains **three** questions of **five** marks each.

Internal choices have been provided in two questions in Section A, two questions in Section B and in all three questions of Section C.

PART- I

[20 Marks]

Answer **all** questions.

1. (a) Answer the following questions briefly and to the point: [8×1]
- *(i) How many chromosomes are present in male gamete of a rat?
 - (ii) Why is haemophilia uncommon in females?
 - *(iii) Name the disease-resistant variety of cowpea developed by plant breeding technique.
 - (iv) Define *Brood parasitism*.
 - *(v) Name the vegetative propagule of *Bryophyllum*.
 - (vi) Which geological era was dominated by reptiles?
 - (vii) Define *polygenic inheritance*.
 - *(viii) What is *Dobson unit*?
- Ans. (ii) Haemophilia is uncommon in females because it is X-linked disease and females have two copies of X-chromosome.
- (iv) Brood parasitism is condition in which a bird leave their egg on the nest of another birds because of resemblance in their colour, For example- cuckoo leave their egg in the nest of crow
- (vi) Mesozoic era.
- (vii) Inheritance of human skin colour is an example of polygenic inheritance. This character is determined by two or more pairs of genes and they have an additive effect. These genes are known as cumulative genes.
- (b) Each of the following sub-parts, (i) to (iv) has four choices. Choose the best option in each case: [4×1]
- (i) If 10 individuals in a laboratory population of 100 mice die during the period of one year, the death rate in this population will be:
- (1) 110 (2) 0.01
(3) 0.1 (4) 90
- (ii) The flowers which open their petals to expose their reproductive parts to allow pollination are called:
- (1) Cleistogamous
(2) Geitonogamous
(3) Chasmogamous
(4) Autogamous
- (iii) Which of the following is paired incorrectly:
- (1) Cyclosporin A - *Trichoderma polysporum*
(2) Streptokinase - *Saccharomyces cerevisiae*
(3) Swiss Cheese - *Propionibacterium*
(4) Penicillin - *Penicillium*
- (iv) The pathogen which cause syphilis:
- (1) *Neisseria*
(2) *Chlamydia*
(3) *Treponema*
(4) *Papilloma virus*
- (c) Give one significant contribution of each of the following scientists: [2×1]
- (i) F. Griffith
(ii) P. Ehrlich

- (d) **Expand the following:** [2×1]
 (i) IUI
 (ii) ADA
- (e) **Define the following:** [2×1]
 (i) Biopiracy
 (ii) Aneuploidy
- (f) **Give a reason for each of the following:** [2×1]
 (i) Cyanobacteria increase the productivity in paddy fields.
 (ii) The shape of the pyramid of biomass in an aquatic ecosystem is inverted.

Ans. (i) **Option (3) is correct.**

$$\text{Mortality rate} = 10/100 = 0.1$$

(ii) **Option (3) is correct.**

Chasmogamous are those flowers which open their petals to allow the pollen grains to enter and stick to the stigma

(iii) **Option (2) is correct.**

Streptokinase is obtained by beta haemolytic *streptococcus*.

(iv) **Option (3) is correct.**

It is caused by the bacteria *treponema pallidum*.

- (c) (i) F. Griffith experiment led to discovered that the DNA is the genetic material not protein. DNA carry genetic information one generation to another generation.

(ii) His greatest contribution was in immunology. He introduced the chemoreceptors and chemotherapy which is used in treatment of cancer.

- (d) (i) Intra Uterine insemination (IUI).
 (ii) Adenosine deaminase (ADA).
- (e) (i) *Biopiracy*: It is the illegally and unlawful act in which exploitation of natural resources and biochemicals happens. For example- Turmeric is a Indian spice which is illegally patented by USA pharmaceutical company.
 (ii) The gain or loss of chromosomes due to failure of segregation of chromatids during cell division is known as *aneuploidy*. e.g. - Down's syndrome results in the gain of extra copy of chromosome 21. Similarly, Turner's syndrome results due to loss of an X chromosome in human females
- (f) (i) Cyanobacteria are nitrogen fixation bacteria in which it release some vitamins, aminoacids, organic material and phytohormones which increase the productivity.
 (ii) In aquatic ecosystem, the biomass of phytoplanktons (producers) are very less then biomass increase at next level (primary consumer) and again highest at next level (secondary consumer). This make a inverted pyramid.

PART- II

[70 Marks]

SECTION - A

[14 Marks]

Answer all questions

2. Give one significant difference between the following: [2]

- (i) *Linkage and crossing over*
 (ii) *Transition and transversion*

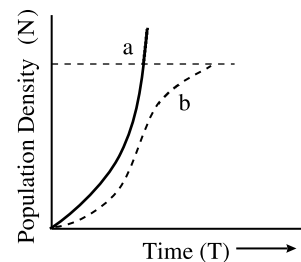
Ans. (i)

Linkage	Crossing Over
Linkage ensures to keep the genes in a chromosome to inherit together.	Crossing over facilitates the separation of genes present in a chromosome and segregate into different gametes

(ii)

Transition	Transversion
There is substitution or interchanges of Purine with purine ring and pyrimidine with pyrimidines	There is exchange of purines with pyrimidine base pairs.

3. Study the graph given below and answer the questions that follow: [2]



- (i) In the absence of predators which one of the two curves would appropriately depict the prey population? Give a reason.
 (ii) Time has been shown on X-axis and there is a parallel dotted line shown above. Explain the significance of this dotted line.

- Ans. (i) B curve represents the prey population as in absence of predator, prey population will increase.
 (ii) This refers to change in population density with time.

4. What is biogas? Name any two main constituents of biogas. [2]

Ans. Biogas is a renewable fuel source which is obtained by the breakdown of organic matter into methane gas and carbon dioxide gas. Methane gas is used in the form of fuel gas.

Two main constituents of biogas are methane and carbon dioxide gas

5. Explain two characteristics of cancer cells. [2]

- Ans. (i) Cancer cells are fast growing abnormal cells which do not need any cell signal for their division.
 (ii) There is loss of normal shape and size or they are disorganized cells that lost their normal cell functions.

6. (a) Draw a labelled diagram of a germinating pollen grain with at least four labellings. [1]

(b) Draw a labelled diagram of a mature human ovum with at least four labellings. [1]

Ans.

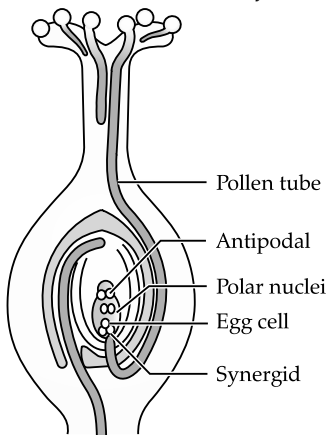
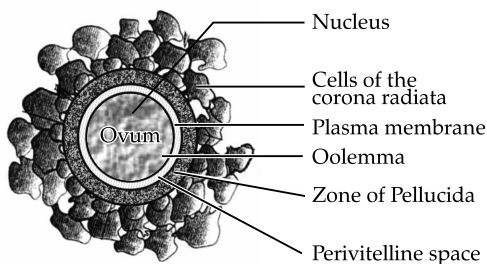


Figure 1: Germinating pollen grain

OR



Structure of mature ovum

Figure-2: Diagram of a mature ovum

*7. What is *outbreeding*? How is it useful in animal breeding? [2]

*8. (a) What is biomagnification? Write two effects of biomagnification. [1]

(b) Write a short note on the contribution of Ahmed Khan of Bangalore. [1]

SECTION - B

[21 Marks]

(Answer all questions)

9. Give three adaptations in organisms by which they avoid predation. [3]

Ans (i) Some insects like frogs are camouflaged (cryptically coloured) to avoid being detected by the predator.

(ii) The Monarch butterfly is highly distasteful to its predator (Bird) due to a special chemical in its body.

(iii) Thorns (Acacia, Cactus, etc.) are the most common morphological means of defence of plants.

(iii) Many plants produce chemicals that make the herbivore sick, inhibit feeding or digestion, disrupt its reproduction or kill it. Example - *Calotropis* (a weed growing in abandoned fields) produce highly poisonous cardiac glycosides. Therefore, cattle or goats do not eat it. Nicotine, caffeine, quinine, strychnine, opium, etc., are defenses against grazers and browsers

10. (a) Define *decomposition*. Explain main steps involved in the process of decomposition.

OR

* (b) Write three causes and three effects of cultural eutrophication. [3]

Ans (a) **Decomposition:** It begins with dead organic matter. It includes fungi and bacteria. They meet their energy and nutrient requirements by degrading dead organic matter or detritus. Decomposers secrete digestive enzymes that breakdown dead and waste materials into simple, inorganic materials, which are subsequently absorbed by them. In an aquatic ecosystem, GFC is the major conduit for energy flow.

Steps involved in decomposition

(i) When any organisms dies at any trophic level, the various microbes present in the pond water decompose the dead remains.

(ii) Decomposers secrete digestive enzymes that breakdown dead and waste materials into simple, inorganic materials.

(iii) The nutrients that are released in the process of decomposition are again available to the producers for the primary productivity.

11. (i) Write two differences between *homologous organs* and *analogous organs*.

(ii) Give one example of homologous organs and one example of analogous organs found in plants. [3]

Ans. (a) Homologous organ are those organs which have similar morphology but different function.

Analogous organs are those organs which have similar functions but different structural properties.

- (b) Homologous example- Venus fly trap and pitcher plant.

Analogous example- Potato and sweet potato.

12. Describe the process of double fertilization in angiosperms. What is its significance? [3]

Ans. Double Fertilisation:

- (i) After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid.
- (ii) One of the male gametes moves towards the egg cell and fuses with its nucleus for syngamy which results in the formation of a diploid cell, the zygote.
- (iii) The other male gamete moves towards the two polar nuclei in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN). As this involves fusion of three haploid nuclei the process is termed as triple fusion.
- (iv) Since two types of fusions i.e., syngamy and triple fusion take place in an embryo sac, the phenomenon is termed double fertilisation.
- (v) The process of double fertilisation is an event unique to flowering plant.
- (vi) The central cell after triple fusion becomes the primary endosperm cell (PEC) and develops into the endosperm while the zygote develops into an embryo.

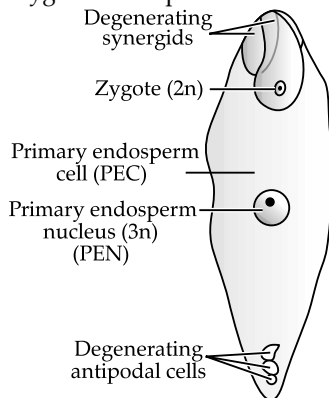


Figure 3: Fertilization in embryo sac

Significance

- (i) Diploid zygote is formed by the fusion of haploid male and female gametes.
- (ii) The pollen which fuse with the polar nuclei form endosperm which provide nutrition to the ovary.

13. What is a bioreactor? Explain important features of a Stirred tank bioreactor. [3]

Ans. Stirred Tank Reactor: A stirred-tank reactor is cylindrical or with a curved base to facilitate the mixing of the reactor contents with available oxygen.

- (a) Alternatively, air can be bubbled through the reactor.
- (b) It is a series of processes such as separation and purification of products after the biosynthetic stage.
- (c) The product is formulated with suitable preservatives.
- (d) Such formulation undergoes thorough clinical trials as in case of drugs.
- (e) Strict quality control testing for each product is also required.
- (f) The downstream processing and quality control testing vary from product to product.

Important features of a stirred tank of bioreactor

- (a) An agitator system.
- (b) An oxygen delivery system.
- (c) A foam control system.
- (d) A temperature control system.
- (e) pH control system.
- (f) Sampling ports, for periodic withdrawal of the culture.

***14. Give three significant differences between asexual reproduction and sexual reproduction. [3]**

15. (a) Explain the process of spermatogenesis in humans.

OR

(b) Give an account of hormonal control of oogenesis. [3]

Ans.(a)

- It is the process of formation of sperms in seminiferous tubules of testes.
- It has two stages namely, (a) Formation of spermatids (b) Spermiogenesis
- During the formation of spermatids, the spermatogonia i.e., sperm mother cells or immature male germ cells produce spermatids.
- In spermiogenesis, the spermatids are transformed into sperm.
- In testis, the immature male germ cells called spermatogonia produce sperms.
- The spermatogonia multiply mitotically and increase in numbers. Each spermatogonium is diploid containing 46 chromosomes.
- Some of the spermatogonia called primary spermatocytes periodically undergo meiosis.

- A primary spermatocyte completes the first meiotic division or reduction division resulting in the formation of two equal, haploid cells called secondary spermatocytes.
- The secondary spermatocytes have only 23 chromosomes each.
- The secondary spermatocytes undergo the second meiotic division to produce four equal, haploid spermatids.
- The spermatids are transformed into spermatozoa or sperms by the process called spermiogenesis.
- After spermiogenesis, sperm heads become embedded in the Sertoli cells, and are released from the seminiferous tubules by the process called spermiation

OR

- (a) • The process of formation of a mature female gamete is called oogenesis.
- It takes place in Graafian follicles.
- FSH control follicular growth and oocyte maturation.
- High level of LH and oestrogen stimulate the rupture of graafian follicle and release of ovum called ovulation.
- Progesterone help the uterus to make ready for receiving the fertilized egg.

SECTION - C [15 Marks]

(Answer all questions)

16. (a) Explain the various steps involved in Recombinant DNA technology. [5]

OR

- (b) Explain the steps involved in the production of human insulin by Recombinant DNA technology. [1]

Ans.(a) Recombinant DNA technology involves several steps in specific sequence as follows:

- (a) Isolation of DNA.
- (b) Fragmentation of DNA by restriction endonucleases.
- (c) Isolation of a desired DNA fragment.
- (d) Ligation of the DNA fragment into a vector.
- (e) Transferring the recombinant DNA into the host.
- (f) Culturing the host cells in a medium at large scale and extraction of the desired product

OR

- (b) • Recombinant DNA technology to make insulin : Two polypeptide chains (Chain – A with 21 amino acids, Chain – B with 30 amino acids) are interlinked through disulphide bridges.
- Insulin is synthesised as a prohormone which contains an extra stretch. Restriction enzymes are used to produce nicks in insulin gene in *E.coli* plasmid at the same restriction sites producing sticky ends.
- Mutant strains of *E.coli* used to avoid bacteria attacking "foreign" genes.
- Insert insulin gene next to *E.coli*'s galactosidase gene which controls transcription.
- Bacterial cells replicate and make copies of insulin gene.
- Insulin protein is purified (*beta-galactosidase removed*). Chains are mixed and disulphide bridges are formed.
- Final product insulin is chemically identical to human insulin.

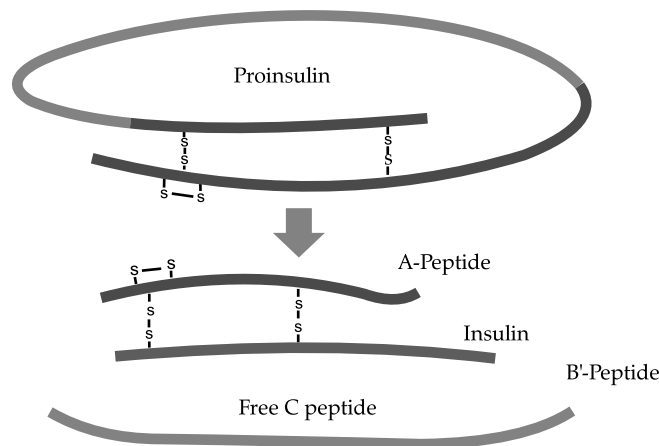


Fig. 4: Maturation of proinsulin into insulin

17. (a) (i) Give an account of Meselson and Stahl's experiment.
 (ii) What is the significance of Meselson and Stahl's experiment?

OR

- (b) (i) Describe the Oparin Haldane Theory of origin of life.
 (ii) The tadpole larva of amphibians resembles fishes. How does this observation support evolution? [5]

Ans. (a)

- (i) The DNA replicates semi-conservatively was shown first in *Escherichia coli*. Mathew Meselson and Franklin Stahl performed the following experiment in 1958:
- (a) They grew *E. coli* in a medium containing ^{15}N NH_4Cl in which ^{15}N is the heavy isotope of nitrogen. This led to the incorporation of ^{15}N into newly synthesized DNA. This heavy DNA molecule could be distinguished from the normal DNA by centrifugation in a Cesium Chloride (CsCl) density gradient.
- (b) Then they transferred the cells into a

medium with normal ^{14}N NH_4Cl and took samples at various definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices. The various samples were separated independently on CsCl gradients to measure the densities of DNA.

- (c) The DNA extracted from the culture one generation after the transfer from ^{15}N to ^{14}N medium had a hybrid or intermediate density. DNA extracted from the culture after another generation was composed of equal amounts of the hybrid DNA and of 'light' DNA.

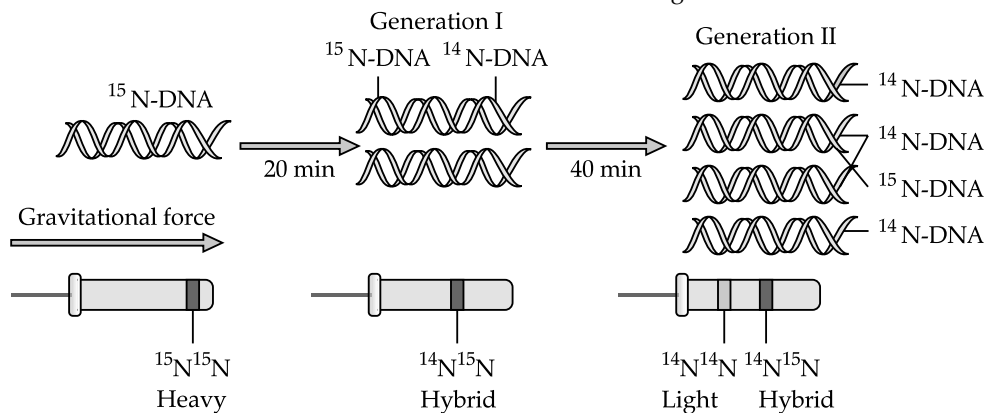


Fig. 5: Mathew Meselson and Franklin Stahl experiment (separation of DNA by centrifugation)

- (ii) The experiment done by Meselson and Stahl demonstrated that DNA replicates semiconservatively, meaning that each strand in a DNA molecule serves as a template for synthesis of a new, complementary strand. It also shows dispersive model. In the dispersive model, DNA replication results in two DNA molecules that are mixtures, or "hybrids," of parental and daughter DNA. In this model, each individual strand is a patchwork of original and new DNA.

OR

- (b) (i) Theory of chemical evolution was proposed by Oparin and Haldane. It states that, the first form of life originated from non-living inorganic & organic molecules such as CH_4 , NH_3 , H_2O , sugars, proteins, RNA, nucleic acids etc. It states "Abiogenesis first, but biogenesis ever since". Harold C. Urey & Stanley L. Miller conducted an experiment to prove theory of chemical evolution.
- (ii) Life emerged in oceans. As the organisms evolved to adapt themselves to terrestrial or land habitat they underwent complex changes like internal reproduction, respiration by lungs etc. The presence of gill slits during some stage of embryonic development in land organisms is indicative of evolution from water to land.

18. (a) Draw a labelled diagram to show the life cycle of *Plasmodium*.

OR

- (b) Draw a labelled diagram to show replication of HIV in human cells.

Ans. (a) Life Cycle of *Plasmodium*:

- (i) Plasmodium enters the human body as sporozoites (infectious form) through the bite of infected female Anopheles mosquito.
- (ii) The parasites initially multiply within the liver cells and then attack the red blood cells (RBCs) resulting in their rupture.
- (iii) The rupture of RBCs is associated with release of a toxic substance, hemozoin, which is responsible for the chill and high fever recurring every three to four days.
- (iv) When a female Anopheles mosquito bites an infected person, these parasites enter the mosquito's body and undergo further development.
- (v) The parasites multiply within them to form sporozoites that are stored in their salivary glands.
- (vi) When these mosquitoes bite a human, the sporozoites are introduced into his/her body. The malarial parasite requires two hosts to complete its life cycle namely, human and mosquito.
- (vii) The female Anopheles mosquito is the vector (transmitting agent).

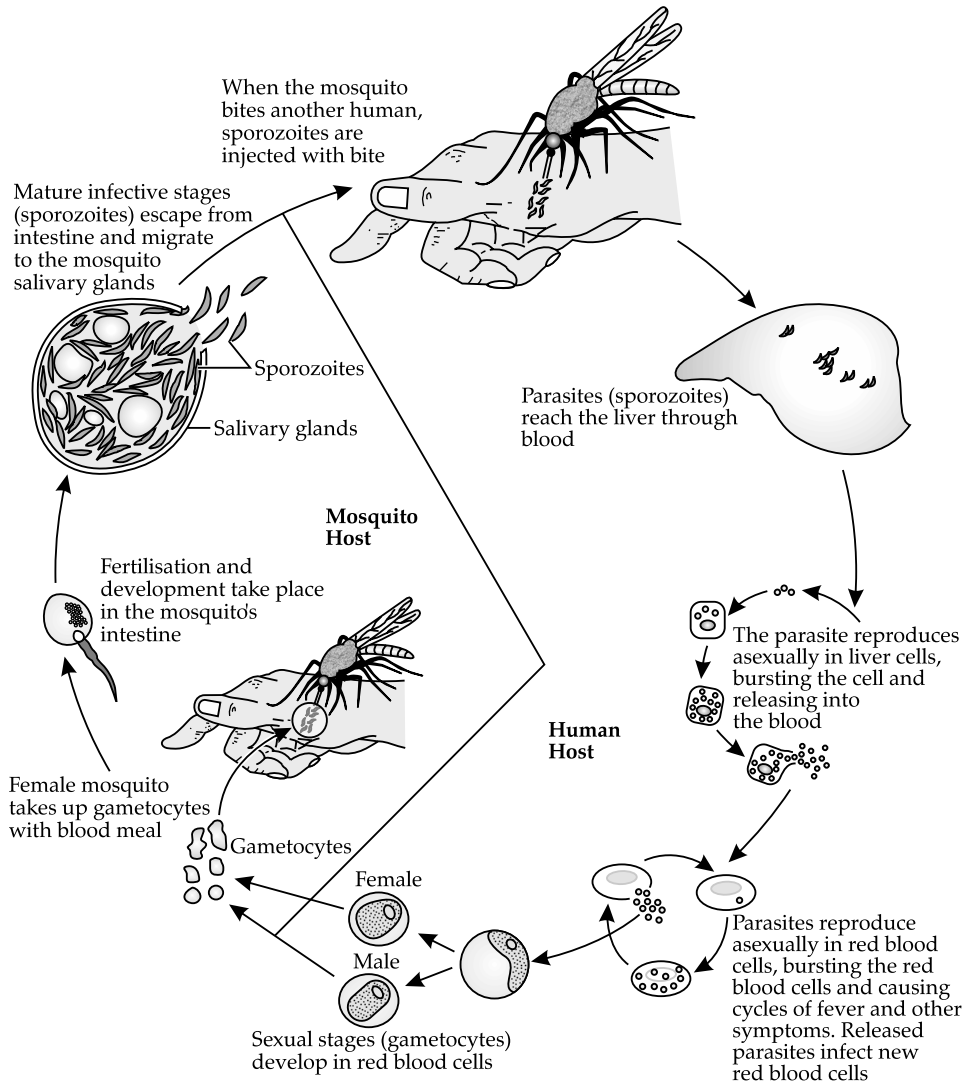


Fig. 6: Stages in life cycle of plasmodium

OR

(b) Replication of AIDS Virus

- (i) After getting into the body of the person, the virus enters into macrophages where RNA genome of the virus replicates to form viral DNA with the help of enzyme reverse transcriptase.
- (ii) The viral DNA enters host cell's DNA and directs the infected cells to produce virus particles. The macrophages produce more and more virus and act as a HIV factory.
- (iii) Simultaneously, HIV enters into helper T-lymphocytes (TH), replicates and produce progeny viruses.
- (iv) The progeny viruses released in the blood attack other helper T-lymphocytes resulting in the decrease in number of helper T-lymphocytes in the body and the person starts suffering from infections that could have been otherwise overcome

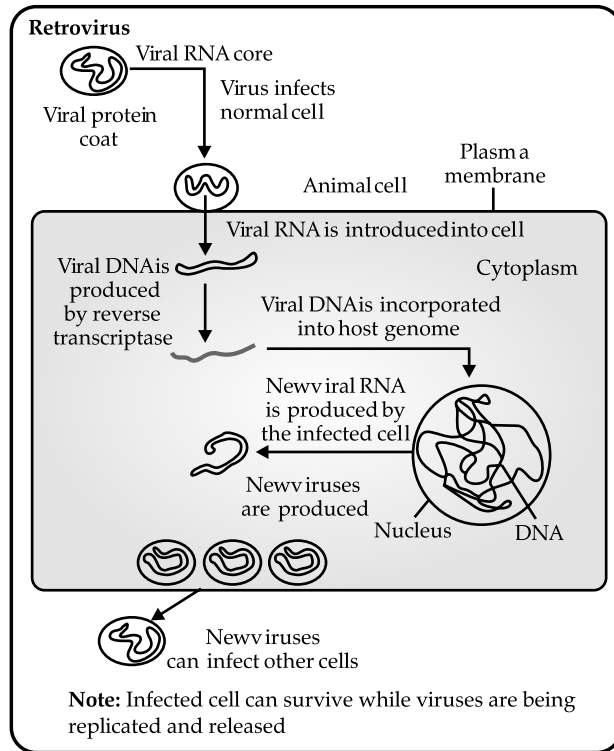


Fig.-7: Replication of Retrovirus

