Class: XII
SESSION : 2022-2023
SUBJECT: BIOLOGY (044)
SAMPLE QUESTION PAPER - 5
with SOLUTION

Maximum Marks: 70 **Time: 3 hours**

General Instructions:

(i) All questions are compulsory.
(ii) The question paper has five sections and 33 questions. All questions are compulsory.
(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. Which of the following groups of plants are highly useful in increasing soil fertility? **[1]**

a) Bacteria b) Red alga

c) Bryophytes d) Fungi

2. Proximal end of the filament of stamen is attached to the: **[1]**

a) Thalamus or petal b) Connective

c) Placenta d) Anther

3. Which of the following is a biofertilizers? **[1]**

a) All of these b) Rhizobium

c) Oscillatoria d) Glomus

4. The factor of extinction of species: **[1]**

a) Urbanization b) Heavy rain

c) Land slide d) Deforestation

5. Interaction of sea anemone and clown fish is: **[1]**

a) Competition b) Mutualism

c) Commensalism d) Parasitism

6. Which of the following is not correct for gastrulation? **[1]**

a) Archenteron is formed b) All germinal layers are formed

c) Morphogenetic movements d) Blastomeres and gastrocoel

degenerate

7. Apomixis is the development of: **[1]**

a) Seeds from reproductive cells after fertilization

b) Seeds with syngamy

c) Seed from vegetative cells after fertilization

d) Seeds without fertilization

8. Segregation of homologous chromosomes occurs during: **[1]**

a) Gametes formation

b) During gene expression

c) During mitosis division

d) During equational division

9. While analyzing the DNA of an organism a total number of 5386 nucleotides were found out of which the proportion of different bases were: Adenine = 29%, Guanine = 17%, Cytosine = 32%, Thymine = 17%. Considering Chargaff s rule, it can be concluded that: **[1]**

a) It is single stranded DNA

b) It is a double stranded linear DNA

c) No conclusion can be drawn

d) It is a double stranded circular DNA

10. The enzyme involved in the replication of DNA is: **[1]**

a) DNA polymerase

b) Nuclease

c) DNA ase

d) RNA ligase

11. Cry I endotoxins obtained from Bacillus thuringiensis are effective against: **[1]**

a) Mosquitose

b) Bollworms

c) Nematodes

d) Flies

12. From which microorganism streptomycin is prepared? **[1]**

a) Streptomyces antibiotics

b) *Streptomyces ramous*

c) *Streptomyces nodosus*

d) *Streptomyces griseus*

13. **Assertion (A):** In birds, the chromosome composition of the egg determines the sex. **[1]**
Reason (R): Female birds are heterogametic.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

14. **Assertion (A):** Lytic cycle is shown by a virulent phage. **[1]**
Reason (R): The host cell undergoes lysis.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

15. **Assertion:** Any population has built-in variation in characteristics. **[1]**
Reason: Those characteristics which enable some to survive better in natural conditions would outbreed others that are less-endowed to survive under such natural conditions.

a) Assertion and reason both are correct statements and reason is correct explanation for the assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

16. **Assertion (A):** Some diseases that attack in childhood do not attack again. **[1]**
Reason (R): Memory cells plays an important role.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

17. List causative agents of the following STDs. **[2]**

i. AIDS

ii. Gonorrhea

18. How many types of restriction endonucleases are found. Why they are called as molecular scissors? **[2]**

19. A child has blood group O. If the father has blood group A and mother blood group B, work out the genotypes of the parents and the possible genotypes of the other offsprings. **[2]**

20. If in a population of size 'N' the birth rate is represented as 'b' and the death rate as 'd', the increase or decrease in 'N' during a unit time period 't' will be: **[2]**
$\frac{dN}{dt} = (b - d) \times N$
The equation given above can also be represented as:
$\frac{dN}{dt} = r \times N$, where r = (b - d)
What does 'r' represent? Write any one significance of calculating 'r' for any population.

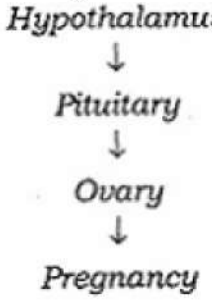
OR

Draw a graph for a population whose population density has reached the carrying capacity.

21. What is foetus? **[2]**

Section C

22. Study the following flow chart and answer the following question: **[3]**



i. Name the hormones involved in each state.

ii. Explain the functions of hormones involved in each state.

iii. Write the name of the placental hormone.

23. Write a short note on microbial biocontrol agents. **[3]**

24. Describe Mendelian disorders and mention its two types giving suitable examples. **[3]**

25. Of the four major causes for the loss of biodiversity **(alien species invasion, habitat loss and fragmentation, over-exploitation and co-extinctions)** which according to you is the major cause for the loss of biodiversity? Give reasons in support. **[3]**

26. Flow of energy through various trophic levels in an ecosystem is unidirectional and non-cyclic. Explain. **[3]**

27. Describe sexually transmitted diseases. Name some important STDs and their causative agents. **[3]**

28. What is the fate of haploid megaspores formed by the megaspore mother cell in an angiosperm plant? **[3]**

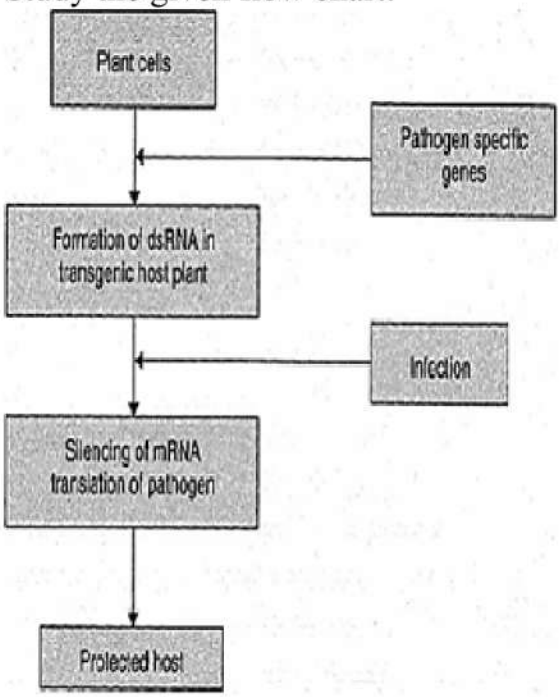
OR

Explain the role of tapetum in the formation of pollen grain wall.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Study the given flow chart:



(i) Name the defence mechanism used.

(ii) In which plant it has been done?

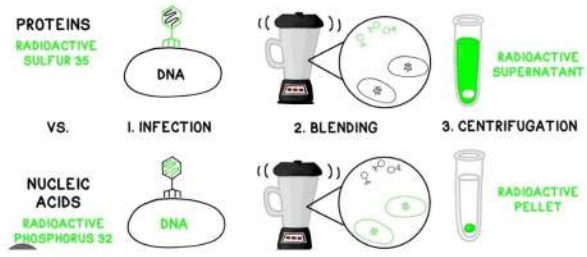
(iii) Name the pathogen.

OR

Name the vector used in this technique.

30. **Read the text carefully and answer the questions:** **[4]**

In 1952, Alfred Hershey and Martha Chase took an effort to find the genetic material in organisms. Their experiments **led to an unequivocal proof to DNA as genetic material**.



Hershey and Chases's experiments:

(i) Name the kind of virus they worked with and why?

(ii) Why did they use two types of culture media to grow viruses in? Explain.

(iii) What was the need for using a blender and later a centrifuge during their experiments?

OR

State the conclusion drawn by them after the experiments.

Section E

31. You have studied the story of Pepper moths in England. Had the industries been removed, what impact could it have on the moth population? Discuss. **[5]**

OR

(a) How does the Hardy-Weinberg's expression $p^2 + 2pq + q^2 = 1$ explain that genetic equilibrium is maintained in a population?
(b) List any two factors that can disturb the genetic equilibrium.

32. Many secondary metabolites of plants have medicinal properties. It is their misuse that creates problems. Justify the statement with an example. **[5]**

OR

What are the methods of cancer detection? Describe the common approaches for the treatment of cancer.

33. Gene therapy is an experimental technique that uses genes to treat or prevent disease. In the future, this technique may allow doctors to treat a disorder by inserting a gene into a patient's cells instead of using drugs or surgery. **[5]**

Clinical gene therapy is given to a 4 years old patient for an enzyme that is crucial for the immune system to function.

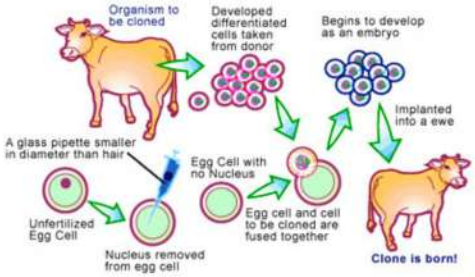
(A) Lymphocytes of the Patient.
↓
(B) _____
↓
(C) Introduction of functional ADA cDNA into Lymphocytes.
↓
(D) _____

Observe the therapeutical flow chart and give the answer to the following:

i. Complete the missing steps (B) and (D)
ii. Identify the disease to be cured.
iii. Why the above method is not a complete solution to the problem? **OR**
iv. Scientists have developed a method to cure this disease permanently. How?

OR

Transgenic animals are routinely used in the laboratory as models in biomedical research. Over 95 percent of those used are genetically modified rodents, predominantly mice. They are important tools for researching human disease, being used to understand gene function in the context of disease susceptibility, progression and to determine responses to a therapeutic intervention.



i. Why are transgenic animals so-called?

ii. Explain the role of transgenic animals in

a. Vaccine safety and

b. Biological products with the help of an example each.

SOLUTION

Section A

1. **(a)** Bacteria
   Explanation: Bacteria
2. **(a)** Thalamus or petal
   Explanation: Thalamus or petal
3. **(a)** All of these
   Explanation: All of these
4. **(d)** Deforestation
   Explanation: Deforestation
5. **(c)** Commensalism
   Explanation: Interaction of sea anemone and clown fish is an example of commensalism. As sea anemone has stinging tentacles and the clownfish lives among them gets protection from the predator.
6. **(d)** Blastomeres and gastrocoel degenerate
   Explanation: Blastomeres and gastrocoel degenerate
7. **(d)** Seeds without fertilization
   Explanation: Seeds without fertilization
8. **(a)** Gametes formation
   Explanation: Segregation of homologous chromosomes occurs during gametes formation. During gametes, the formation reduction division of meiosis division occurs in which the number of chromosomes reduces to half.
9. **(a)** It is single stranded DNA
   Explanation: It is single-stranded DNA
10. **(a)** DNA polymerase
    Explanation: DNA polymerase
11. **(b)** Bollworms
    Explanation: Bollworms
12. **(d)** *Streptomyces griseus*
    Explanation: Streptomycin is in the aminoglycoside class of medication. It works by blocking the ability of 30S ribosomal subunits to make proteins which results in bacterial death.
    Streptomycin was discovered in 1943 from Streptomyces griseus. It is on the World Health Organization's List of Essential Medicines, the most effective and safe medicines needed in a health system.
13. **(b)** Both A and R are true but R is not the correct explanation of A.
    Explanation: In birds, the chromosomal composition of the egg determines the sex. This is called genetic sex determination, with females being heterogametic. But being heterogametic is alone, not responsible for sex determination. Other factors like specific genes or autosomal, sex chromosome ratio, etc., are responsible.
14. **(b)** Both A and R are true but R is not the correct explanation of A.
    Explanation:
    A virulent bacteriophage like T_2, T_4, etc. infects a host bacterium. It entirely depends on the host for its multiplication. It subverts the host's function and utilizes the host machinery for producing a large number of progeny phage particles. The bacterium cell undergoes lysis and dies to liberate a large number of phage particles. New phage particles infect

other host cells. This cycle is known as lytic cycle.

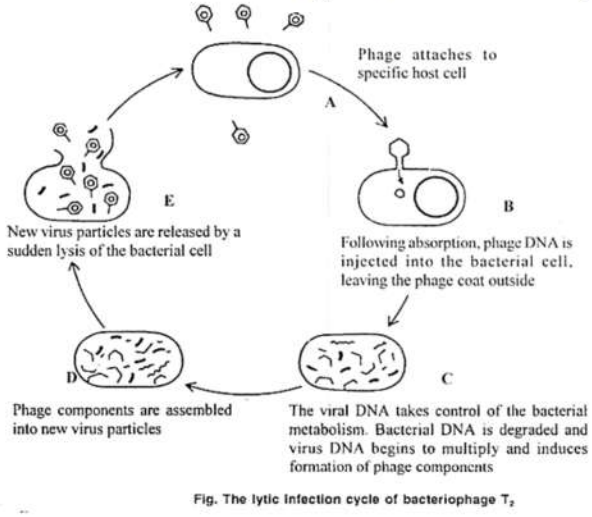


Fig. The lytic infection cycle of bacteriophage T_2

15. **(b)** Assertion and reason both are correct statements but reason is not correct explanation for assertion.
    Explanation: Assertion and reason both are correct statements but reason is not correct explanation for assertion.
16. **(a)** Both A and R are true and R is the correct explanation of A.
    Explanation: This can be explained in terms of memory cells. After the infection disappears as a result of antigen-antibody interaction and killer T-cell-nonself cell interaction, some of the specific lymphocytes remain in lymphatic tissue as "memory or primed cells" which are ready to produce the antibodies and killer cells if the same antigens reappear. That is why the second attack of the infectious disease elicits quick and abundant antibody formation. The memory cells can give rise to more effector cells and memory cells in case of a second attack of antigens. Whereas the effector cells have a life of a few days only, and the memory cells live long, some even for whole life. The memory cells are stored in the spleen and lymph nodes.

Section B

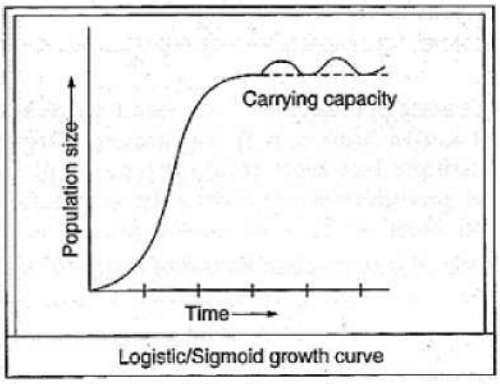
17. i. The causative agent of AIDS is HIV
    ii. The causative agent of Gonorrhea is Neisseria gonorrhoeae
18. Restriction enzymes are classified biochemically into three types. These are designated as Type I, Type II, and Type III. A major type of Type II enzymes are sometimes referred to as Type IV enzymes.
    Restriction enzymes are also called 'molecular scissors' as they cleave DNA at or near specific recognition sequences known as restriction sites. These enzymes make one incision on each of the two strands of DNA and are also called restriction endonucleases.
19. Since the blood group of the child is O so it must be homozygous for the allele I^0I^0. Since the parents have blood groups A and B and produce a child with O blood group, they must have to contribute the I^0 gene and be heterozygous that is the genotype of the father must be I^AI^O and the genotype of the mother be I^BI^O.
    The genotypes of the other possible offsprings will be:-

♀ \ ♂	I^A	I^O
I^B	I^AI^B	I^BI^O
I^O	I^AI^O	I^OI^O

20.
    - **'r' represents** the intrinsic rate of natural increase.

- **Significance of calculating 'r' for any population-** It is an important parameter for assessing the impacts of any biotic or abiotic factor on population growth.

OR



Logistic/Sigmoid growth curve

21. An unborn offspring of a mammal, in particular of human more than eight weeks after conception connected to placenta by umbilical cord is called a foetus.

Section C

22. i. The hormones involved in each stage are as follows:
    a. **Hypothalamus-** Gonadotropin-releasing hormone (GnRH)
    b. **Pituitary-** FSH and LH
    c. **Ovary-** LH
    d. **Pregnancy-** Progesterone and Human chorionic gonadotropin (hCG)

    ii. The functions of the hormone involved in each stage are as follows:
    a. **Hypothalamus:** It releases gonadotropin-releasing hormone (GnRH), which stimulates pituitary.
    b. **Pituitary:** After stimulation, it secretes FSH and LH. FSH regulates the functioning of the ovary during follicular phase by stimulating the growth of an ovarian follicle into mature Graafian follicle and secretion of oestrogens from the follicle cells. LH stimulates the mature follicle to rupture and release the ovum(ovulation).
    c. **Ovary:** After ovulation LH stimulates the formation of corpus luteum inside the ruptured follicle.
    d. **Pregnancy:** Corpus luteum starts the secretion of progesterone and hCG is secreted from the placenta which is essential for the maintenance of pregnancy.

    iii. Human chorionic gonadotropin (hCG) hormone is secreted from the placenta.

23. Microbial biocontrol agents are the microbes which are used to control the pest of the crops. For example
    i. In order to control butterfly, caterpillars, bacteria *Bacillus thuringiensis* are used. The bacteria are available in the market in sachets as sprayed on to susceptible sensitive plants such as Brassica and fruit trees which are eaten by the insect larvae. In the gut of the larvae, the toxin is released and the larvae get killed. The bacteria will kill the caterpillars but leave another insect unharmed.
    ii. The fungus Trichoderma species are free-living commonly found into root ecosystem. They are effective biocontrol agents of several plant pathogens.

24. Mendelian disorders are determined by mutation in the single gene and transmitted to the offspring as per Mendelian principles.
    The pattern of inheritance of such Mendelian disorders can be traced in a family by Pedigree analysis. The Mendelian disorders are of two main types:
    (i) Gene Mutations in sex chromosomes. Examples: Sickle cell anaemia and Phenylketonuria.
    (ii) Gene mutations in sex chromosomes. Example: Haemophilia.

25. Out of the four major causes for the loss of biodiversity, loss of habitat and fragmentation is the major cause because of the following reasons-
    i. Habitat loss and fragmentation caused by clearing and over-exploitation of forest areas for agriculture, urbanisation and industrialisation, results in the destruction of natural habitats.
    ii. Increasing human population has overburdened the forest resources and have destroyed forest land, which means loss of habitat for several species.
    iii. In addition, large habitats are broken up into small fragments, because of which mammals and birds requiring large territories and migratory habitats are badly affected, leading to declining in population.
26. About 90 % of the energy consumed by an organism at a particular trophic level is dissipated in the form of heat energy. This leaves just 10 % for the organism at the next trophic level. By the time, energy moves from producers to topmost consumers; the available energy is a minuscule portion of the energy which was originally converted by the producer. Due to this, energy flow is unidirectional through various trophic levels and is non-cyclic.
27. Diseases or infections which are transmitted through sexual intercourse are collectively called sexually transmitted diseases or venereal diseases or reproductive tract infections.

Name of STD	**Causative agent**
(1) Trichomoniasis	(1) Trichomonas Vaginalis (A protozoan)
(2) Genital Herpes	(2) Herpes simplex (A virus)
(3) Syphilis	(3) Treponema pallidum (A bacterium)
(4) Gonorrhoea	(4) Neisseria gonorrhoeae (A bacterium)
(5) AIDS	(5) HIV (A retrovirus)

28. The diploid megaspore mother cell divides meiotically and forms four megaspores, which are usually arranged in a longitudinal row (linear tetrad). Out of four megaspores formed, three degenerate. The remaining one acts as functional megaspore (chalazal). The nucleus of functional megaspore undergoes three successive mitotic divisions forming eight haploid nuclei, which get organized into three groups -three nuclei migrate to the micropylar end and form the egg apparatus (one egg cell, two synergids). Three migrate towards chalazal end and form antipodal cells. Two polar nuclei fuse to form a diploid secondary nucleus in the centre.

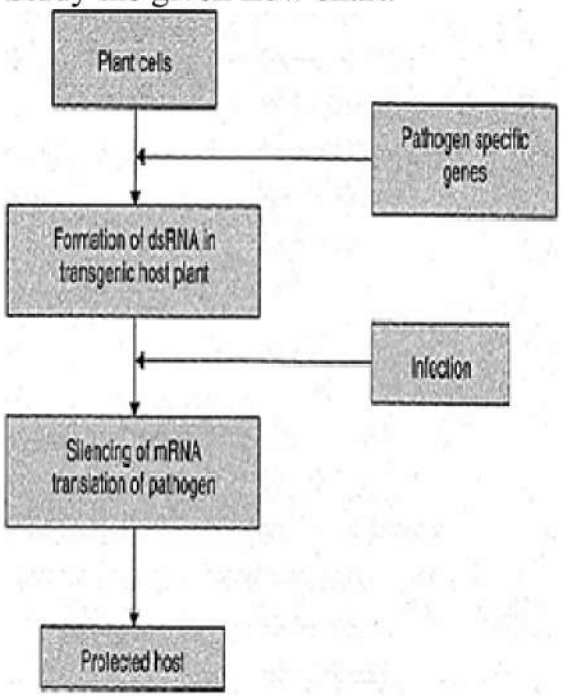
OR

The tapetal cells provide nutrition to the developing pollen grains. Tapetum secretes both enzymes and hormones and special proteins for the pollen grains to recognize compatibility. Tapetum produce ubisch granules for the formation of exine of pollen grain. Tapetum secrete pollenkitt over outerside of mature pollen.

Section D

29. **Read the text carefully and answer the questions:**

Study the given flow chart:



(i) RNA interference (RNAi)
(ii) Tobacco plant
(iii) Meloidegyne imcognitia (nematode)

OR

Agrobacterium tumefacines vector.

30. **Read the text carefully and answer the questions:**

In 1952, Alfred Hershey and Martha Chase took an effort to find the genetic material in organisms. Their experiments **led to an unequivocal proof to DNA as genetic material**.

Hershey and Chases's experiments:

(i) They worked with bacteriophage, i.e. viruses that infect bacteria. These viruses were used because during infection they transfer their genetic material into bacteria.

(ii) They used two types of culture media, containing ^{35}S and ^{32}P, so as to compare that which one out of DNA and proteins gets transferred from virus to bacteria and act as genetic material.

(iii) A blender and centrifuge were used to open up the bacterial cells and viral particles, so, that genetic material could be visualised.

OR

They concluded that DNA is the genetic material that is passed from virus to bacteria.

Section E

31. In the population of Peppermoth, two variants were already existing in the population, the black and the grey. In the absence of industrialisation, the grey moths were prevalent because they blended very well with the lichen and moss-covered trees camouflage and the

predators cannot spot them. The black ones were easily spotted and killed by predators and therefore were fewer in numbers. With industrialisation, the stems got covered with black soot. This provided better camouflage with the black variant and their number increased. If the industries had been removed the population of black moths would have declined because as stated earlier they would have been spotted better by predators and therefore be eaten more frequently.

OR

(a) This principle states that allele frequencies in a population are stable and constant from generation to generation. In the expression p and q represent the frequency of allele A and allele a. The frequency of AA in a population is p^2, of aa is q^2 and of Aa is 2pQ. Hence $p^2 + 2pq + q^2 = 1$, where p^2 represents the frequency of the homozygous dominant genotype (AA), 2 pq represents the frequency of the homozygous genotype (Aa) and q^2 represents the frequency of homozygous recessive genotype (aa). Sum total of all the allelic frequencies is 1.

(b) The factors which can disturb the genetic equilibrium are -

(i) Genetic drift (ii) Mutation

32. Morphine is a good example of a plant metabolite which is a very strong painkiller. But morphine is abused by many people for getting intoxicated. Similarly, codeine comes from opium plants. Codeine is used in cough syrups and is highly effective in suppressing coughing. But many people gulp down the whole bottle of cough syrup to get intoxicated. Drug abuse makes a person hallucinogenic and the person becomes useless not only for the society but also for himself. In extreme cases, drug addicts resort to petty crimes to get money to buy their daily fix. So, drug abuse is not only a behavioral problem but also a social problem.

OR

Following are the methods of cancer detection:

Biopsy: In this process, a small fragment of the suspicious tissue is extracted, cut into thin sections, is stained and examined under a microscope (histopathological studies) by a pathologist. This helps in determining any abnormality in the cells.

Blood Test and Bone Marrow Test: These tests show increased levels of cell count. This helps the doctor to diagnose the problem. Imagery Technique: X-ray, CT scan, and MRI help in diagnosing the cancer of internal organs.

Apart from the above-mentioned techniques; antibodies against cancer-specific antigens and molecular biotechnology are also used in certain cases.

Common approaches to treatment involve surgery, radiotherapy, and immunotherapy:

i. Surgery: This involves the removal of the tumor through surgery.
ii. Radiotherapy: In radiotherapy, tumor cells are irradiated lethally, taking proper care of the normal tissues surrounding the tumor mass.
iii. Immunotherapy: This involves the use of alpha-interferon so that some stubborn cancer cells can be destroyed by chemotherapeutic drugs.

33. i. Step (B): Lymphocytes are grown in the culture medium.
Step (D): Infusion of genetically engineered lymphocytes into patients.
ii. Adenosine deaminase (ADA) deficiency.
iii. As genetically engineered lymphocytes are not immortal, the patient requires the periodic infusion of cells.
iv. If the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

OR

i. Transgenic animals are those that have had their DNA manipulated to possess and express an extra/foreign gene e.g., Transgenic rats, rabbits, pigs, sheep, cow, fish and mice.

ii. a. **Vaccine safety:** Transgenic mice/monkeys are being developed for use in testing the safety of vaccines (e.g., polio vaccine**)**

b. **Biological products:** Animals producing useful biological compounds can be created by introducing a portion of DNA that codes for that product from other organisms, e.g., α-I-antitrypsin, a human protein used to treat emphysema. The first transgenic cow, Rosie, produced the human-protein enriched milk (2.4 g/litre); it also contained human alpha lactoalbumin, a more nutritionally balanced product for human babies.