CBSE Class 12 Biology

Sample Paper 09 (2020-21)

Maximum Marks: 70

Time Allowed: 3 hours

General Instructions:

i. All questions are compulsory.
ii. The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
iii. Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D 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. Explain the term implantation. After which event does it takes place?
2. What is the source organism for EcoRI, restriction endonuclease?
3. What are the characteristic features of a true-breeding line?
4. Define vasectomy and tubectomy. Have they any side effect?
5. How is repetitive/satellite DNA separated from bulk genomic DNA for various genetic experiments?
6. The phenotypic and genotypic ratios in F_2 generation are same in a certain kind of inheritance. Name and organism in which it occurs and mention the kind of inheritance involved.
7. What kind of test will you perform to find out whether the given plant is homozygous dominant or heterozygous?
8. Some allergens trigger sneezing and wheezing in human beings. What causes this type of response by the body?
9. About 200 species of cichlid fish became extinct when a particular fish was introduced in

Lake Victoria of Africa. Name the invasive fish.

10. State one reason for adding blue-green algae to the agricultural soil.
11. **Assertion:** An organism with a lethal mutation may not even develop beyond the zygote stage.

    Reason: All types of gene mutations are lethal.

    a. The assertion is a true statement but the reason is false.
    b. Both assertion and reason are true and the reason is the correct explanation of the assertion.
    c. Both assertion and reason are true but the reason is not the correct explanation of the assertion.
    d. Both assertion and reason are false.

OR

Assertion: The cross between red and white flower bearing snapdragon plants results in a pink coloured flower.

Reason: Incomplete dominance of red and white flower results into pink coloured flower.

a. Both assertion and reason are correct.
b. The assertion is correct but the reason is incorrect
c. The assertion is incorrect but the reason is correct.
d. Both assertion and reason are incorrect.

12. **Assertion**: The secondary host of *Taenia solium* is a pig.

    Reason: Malarial parasite completes its life cycle in the blood of human beings alone.

    a. The assertion is correct but the reason is wrong
    b. Both assertion and reason are correct
    c. Both assertion and reason are wrong
    d. The assertion is incorrect but the reason is correct.
13. **Assertion:** The first milk after the birth of a baby is called colostrum.

    Reason: Colostrum is rich in proteins, calories, and antibiotics.

    a. Assertion and reason both are correct
    b. The assertion is correct but the reason is incorrect
    c. Both assertion and reason are incorrect
    d. The assertion is incorrect but the reason is correct

14. **Assertion:** *Bacillus thuringiensis* forms protein crystals during a particular phase of growth.

    Reason: These crystals contain a toxic insecticidal protein that kills certain insects.

    a. Both assertion and reason are correct
    b. Assertion is correct but reason is incorrect
    c. Assertion is incorrect but reason is correct
    d. Both assertion and reason are incorrect

15. **Read the following and answer any four questions:**

    The female reproductive system consists of a pair of ovaries along with a pair of oviducts, uterus, cervix, vagina and the external genitalia located in the pelvic region. These parts of the system along with a pair of the mammary glands are integrated structurally and functionally to support the processes of ovulation, fertilisation, pregnancy, birth and child care. Each ovary is about 2 to 4 cm in length and is connected to the pelvic wall and uterus by ligaments. The oviducts which consist of 3 parts, uterus and vagina constitute the female accessory ducts. The uterus is single and it is also called the womb. The shape of the uterus is like an inverted pear. The wall of the uterus has three layers of tissue.

    i. The ovarian stroma is divided into two zones _____ and _____.
        a. peripheral cortex
        b. inner medulla
        c. both (a) and (b)
        d. fimbriae

    ii. Which of the following is not the part of the fallopian tube
        a. Labia minora
        b. Fimbriae
        c. Infundibulum
        d. Isthmus

    iii. The last part of the oviduct is called :
        a. Isthmus
        b. Ampulla
        c. Fimbriae
        d. Infundibulum

    iv. The opening of the vagina is often covered partially by a membrane called:
        a. Clitoris

b. Majora
c. Isthmus
d. Hymen

v. **Assertion-** The endometrium undergoes cyclical changes during the menstrual cycle while the myometrium exhibits strong contraction during.
Reason- The cavity of the cervix is called cervical canal which along with vagina forms the birth canal.
a. Both Assertion and Reason are true and Reason is the correct explanation of the Assertion
b. Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion
c. The Assertion is true but the Reason is false
d. Both the statements are false

16. **Read the following and answer the four questions:**
Biogas is a mixture of gases (containing predominantly methane) produced by microbial activity and which may be used as fuel and produce different types of gaseous end-products during growth and metabolism. The type of gas produced depends upon the microbes and the organic substrates they utilize. A lot of cellulosic material present in the food of cattle is also present in the rumen. In the rumen, these bacteria help in the breakdown of cellulose and play an important role in the nutrition of cattle. The biogas plant consists of a concrete tank (10-15 feet deep) in which bio-wastes are collected and a slurry of dung is fed. Cattle dung is available in large quantities in rural areas where cattle are used for a variety of purposes. So biogas plants are more after building in rural areas. The biogas thus produced is used for cooking and lighting

i. Methanogens, growing anaerobically on cellulosic material produce
a. methane
b. methane and carbon dioxide
c. methane and hydrogen
d. methane, carbon dioxide and hydrogen

ii. Which of the following bacteria is present in the rumen of cattle?
a. Azotobacter
b. Rhizobium
c. Methanobacterium

d. Azospirillum

iii. Biogas is produced by/with

a. aerobic breakdown of biomass

b. anaerobic breakdown of biomass

c. the help of methanogenic bacteria

d. both (b) and (c)

iv. Select the correct statement from the following

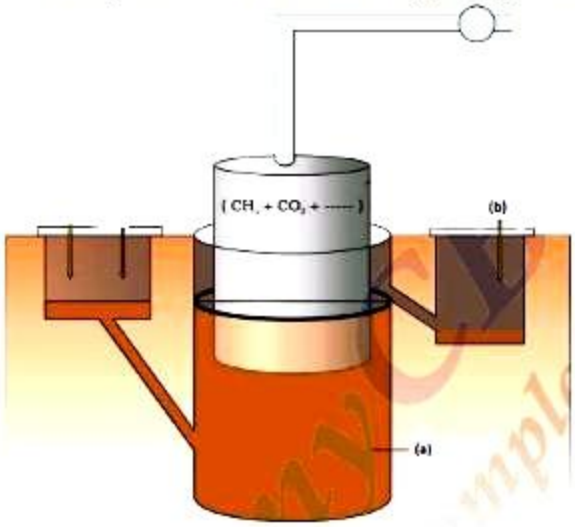
a. Activated sludge-sediment in settlement tanks of the sewage treatment plant is a rich source of aerobic bacteria

b. Biogas is produced by the activity of aerobic bacteria on animal waste

c. Methanobacterium is an aerobic bacterium found in the rumen of cattle

d. Biogas, commonly called gobar gas, is pure methane

v. Identify (a) and (b) in the figure given below



a. a - gas holder, b - sludge

b. a - digester, b - sludge

c. a - dung, b - water

d. a - gas holder, b - digester

Section B

17. Do you think that reproductive health in our country has improved in the past 50 years? If yes, mention some such areas of improvement
18. What is the phenotypic and genotypic ratio of incomplete dominance?
19. State the role of C-peptide in human insulin.
20. Highlight any four areas where genetic modification of plants has been useful.

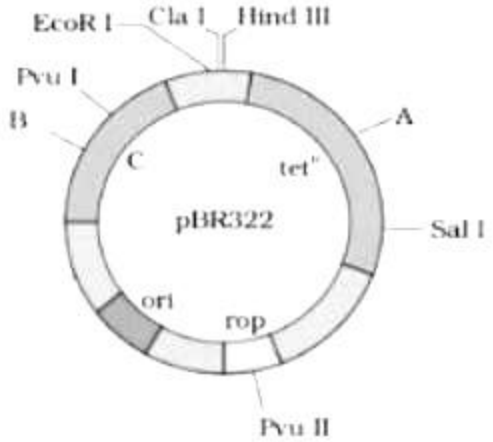
OR

What is gene therapy? Name the first clinical case in which it was used.

21. A template strand is given below. Write down the corresponding coding strand and the mRNA strand that can be formed, along with their polarity.
    3' - ATGCATGCATGCATGCATGCATGC-5'
22. What are selectable markers? Give examples.

OR

Name the regions marked A, B and C.



23. What is cryopreservation?
24. Describe the mutual relationship between fig. tree and wasp and comment on the phenomenon that operates in their relationship.
25. What is the most important cause of biodiversity loss?

Section C

26. What is a criss-cross inheritance? Give its importance.
27. Explain the role of ^{35}S and ^{32}P in the experiments conducted by Hershey and Chase.
28. How HIV multiplies in the host body?
29. Why RNA is not a suitable genetic material in comparison with DNA? Explain.
30. Define the term addiction. Name some drugs which are normally used as medicines but are often abused.

OR

Name the cells that act as HIV factory in humans when infected by HIV. Explain the events that occur in the infected cell.

Section D

31. i. Geitonogamy is functionally a cross-pollination, but genetically similar to autogamy. Explain.

    ii. Why do flowering plants need to develop outbreeding devices? Explain any three such devices developed by flowering plants.

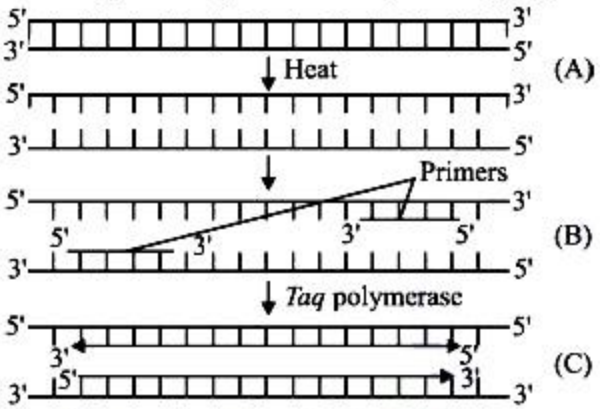
OR

With a neat, labeled diagram, describe the parts of a mature angiosperm embryo sac. Mention the role of synergids.

32. What are the applications of Recombinant DNA technology?

OR

In the given figure, one cycle of polymerase chain reaction (PCR) is shown:



i. Name the steps A, B and C.

ii. Give the purpose of each of these steps.

iii. State the contribution of *Thermus aquaticus* in this process.

33. i. What is population density? Why are ecologists interested in measuring it?

    ii. Write the different ways of measuring population density. Explain any two with the help of specific examples.

OR

Explain how tolerance to environmental factors determines the distribution of species.

CBSE Class 12 Biology

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Solution

Section A

1. The attachment of the blastocyst to the uterine wall is called implantation. It takes place after fertilization when zygote develops in morula and morula transforms into blastocyst.
2. *E.coli* is the source organism for EcoRI, restriction endonuclease.
3. Following are the characteristic features of a true-breeding line:
   i. Self-pollination through successive generation.
   ii. Stable trait inheritance through several generations.
   iii. Stable expression of characters through several generations.
4. **Vasectomy:** Cutting and ligating vas-deferens as a means of contraception in males.
   Tubectomy: Cutting and ligating fallopian tubes as a means of contraception in females.
   Both the techniques of surgery to avoid pregnancy, have no significant side effects.
5. Satellite DNA is separated from bulk genomic DNA by density-gradient centrifugation technique.
6. It occurs in snapdragon / antirrhinum sp. (dog flower). The inheritance involved is incomplete dominance.
7. Test cross will be performed where the given plant is crossed with recessive plant.
8. An allergic reaction occurs when a person develops “allergic” antibodies, called IgE, which are specific for an allergen. The IgE antibodies bind tightly to allergic cells, called mast cells or basophils, in the skin, airways, gastrointestinal tract and around blood vessels. The allergic cells get activated when the bound IgE recognizes an allergen, and these cells then release histamine and serotonin chemicals that can cause hives, runny nose, sneezing, wheezing and itching.
9. Nile Perch. Introduction of this large predator fish in the lake caused the extinction of the native fish.
10. Blue-green algae are added to agricultural soil because they add organic matter to the soil and also increase its fertility.
11. (a) The assertion is a true statement but the reason is false.
    Explanation: An organism with the lethal mutation may not even develop beyond the

zygote stage due to change in the gene but all kinds of mutations are not lethal. The mutation is the main source of variation essential for evolution.

OR

(a) Both assertion and reason are correct.

Explanation: In Snapdragon flower, a cross between true-breeding white and red coloured flower produces a pink coloured flower in F1generation. This happens due to incomplete dominance of alleles over the other.

12. (a) The assertion is correct but the reason is wrong

    Explanation: *Taenia solium* completes its life cycle in humans as the definitive host and pigs as intermediate hosts. It is transmitted to pigs through human feces or contaminated fodder, and to humans through uncooked or undercooked pork.

    The malarial parasite completes their life cycle in two hosts human beings and female anopheles mosquito.

13. (a) Assertion and reason both are correct

    Explanation: The first milk after the birth of a baby is called colostrum. It is rich in proteins, calories, and antibiotics necessary for the proper health of the baby.

14. (a) Both assertion and reason are correct

    Explanation: *Bacillus thuringiensis* bacterium forms protein crystals during a particular phase of growth. The crystal of toxic protein has insecticidal protein. This protein gets activated in an alkaline medium in the gut of insects and kills them.

15. i. (c) both (a) and (b)
    ii. (a) Labia minora
    iii. (a) Isthmus
    iv. (d) hymen
    v. (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion

16. i. (d) methane, carbon dioxide and hydrogen
    ii. (c) Methanobacterium
    iii. (d) both (b) and (c)
    iv. (c) Methanobacterium is an aerobic bacterium found in the rumen of cattle
    v. (b) a - digester, b - sludge

Section B

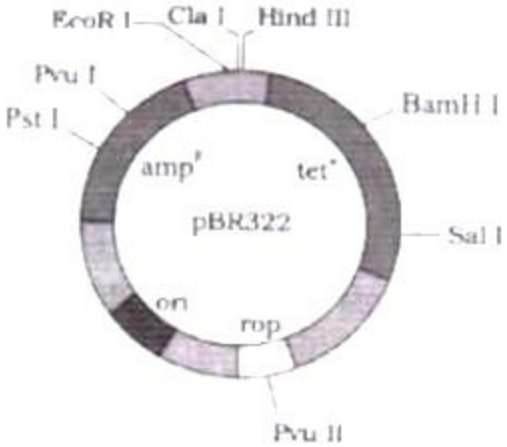
17. Yes, the programmes like family planning and reproductive and child health care have been successfully launched. Now more people are aware about the advantages of small family and are accepting two children norm. Some such areas of improvement are massive child immunization, increasing use of contraceptives, family planning etc.
18. The phenotypic ratio is 1 : 2 : 1
    The genotypic ratio is 1 : 2 : 1
19. The C-peptide is an extra stretch of the peptides that connect the A and B-polypeptide chains of insulin in prohormone. During processing to release mature and functional insulin, this C-peptide is removed.
20. Genetic modification of plants has been useful in following areas:
    i. Increased tolerance to abiotic stress (drought, salinity, high temperature, etc.)
    ii. Increased tolerance to biotic stress; like pests and weeds.
    iii. Increased efficiency of mineral usage from soil.
    iv. Enhanced nutritional value.

OR

Gene therapy is a corrective therapy or technique of genetic engineering that is used to replace a faulty or non-functional gene with a normal healthy functional gene.
The first clinical gene therapy was given to a 4-year-old girl with ADA (Adenosine Deaminase) deficiency in 1900. It is caused due to the deletion of the gene coding for ADA, which adversely affects the functioning of the immune system.

21. For the given template strand 3' - AT G C AT G C AT G C AT G C AT G C AT G C - 5'
    Coding strand is 5' - T A C G T A C G T A C G T A C G T A C G T A C G - 3'
    and mRNA strand is 5' - U A C G U A C G U A C G U A C G U A C G U A C G -3'
22. Selectable markers are the genes which help in identifying and eliminating non-transformants and will permit the growth of transformants only.
    Example: Gene coding for reesistance to ampicillin (amp*) gene coding for resistance to tetracycline (tet*) antibiotic.

OR



i. A shows BamH I restriction site
ii. B shows restriction site Pst I
iii. C shows the ampicillin resistance site

23. It is technique to preserve seeds of plants, cells, sperms, ova, embryonic tissues of animals in liquid nitrogen at a temperature of -196°
In Cryopreservation, the cells or tissues are frozen slowly to preserve them in their current state, so that they can be used in future.
24. The relationship between fig tree and wasp shows mutualism. The wasp while searching for sites to lay its eggs, pollinates the fig's inflorescence. On the other hand, the fig not only provides shelter (fruit) for oviposition to wasp but also allows its larvae to feed on seeds.
25. Habitat loss and fragmentation.This is the most important cause driving animals and plants to extinction. When large habitats are wiped out or broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population decline.

Section C

26. **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.

27. Hershey and Chase used ^{35}S and ^{32}P in their culture medium. These are radioactive sulphur and phosphorus, respectively. These two components were used to detect whether the genetic material is DNA or protein.

    Role of ^{32}P and ^{35}S Viruses grown on medium with ^{32}S, had non-radioactive genetic material and radioactive protein as sulphur is not present in DNA but found in protein.

    While those grown on ^{32}P had radioactive genetic material because DNA contain phosphorus but proteins does not contain it. Thus, it was established that DNA is the genetic material.

28. HIV enters into macrophages and its RNA replicates with the hosts cell DNA, so the infected cells produce virus particles and finally act as HIV factory. Now HIV enters into T-lymphocytes to replicate and thus there is a decrease in number of Helper T-cells.

29. (i) RNA functions as an enzyme and is therefore reactive and unstable
    (ii) Uracil present in the RNA is less stable as compared to thymine of DNA
    (iii) Being unstable RNA mutates at a much faster rate, that is why RNA viruses have shorter life span and mutate and evolve very fast. Such rapid changes are harmful to higher forms of life.

30. Addiction is a psychological attachment to certain effects - such as euphoria and a temporary feeling of well-being associated with drugs and alcohol.
    Barbiturates, amphetamines, benzodiazepines and LSD (Lysergic acid diethyl amides) are normally used as medicines to help patients cope with mental illnesses are often abused.

OR

Macrophages act as HIV factory

Events: - Inside the macrophage RNA of the virus replicates to form DNA with the help of enzyme reverse transcriptase.

- The viral DNA gets incorporated into the host cells DNA and directs the infected cells to produce more virus particles.

- Simultaneously, HIV enters into the helper T cells and replicate there to produce

progeny virus.

- The progeny viruses released in the blood and attack other T-cells. This is repeated leading to a decrease in number of helper T-cells

Section D

31. i. Transfer of pollen grains from the anther to the stigma of another flower of the same plant is called geitonogamy. It is functionally cross-pollination as it involves a pollinating agent, but genetically similar to autogamy since, the pollen grains come from the same plant (genetically same parent).

    ii. Continued self-pollination results in inbreeding depression because a majority of flowering plants produce hermaphrodite flowers and pollen grains generally come in contact with the stigma of the same flower. To discourage this, flowering plants developed many devices. The three such devices developed by flowering plants are

    I. **Unisexuality** (Dicliny) -Flowers are unisexual so that self-pollination is not possible. The plants may be monoecious (bearing both male and female flowers on different plants, e.r., mulberry, papaya).

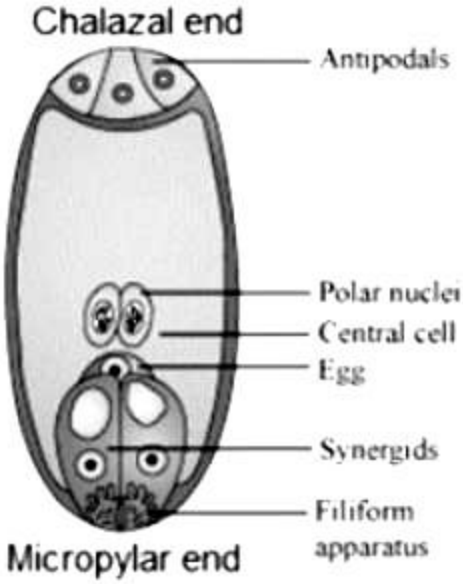
    II. **Dichogamy** - Anthers and stigmas mature at different times in a bisexual flower for preventing self-pollination

        a. **Protandry** - Anthers mature earlier than the stigma of the same flower. The pollens thus become available to stigmas of the older flowers, e.g., sunflower, Salvia.

        b. **Protogyny** - Stigmas mature earlier so that they get pollinated before the anthers of the same flower develop pollen grains, e.g., Mirabilis jalapa, Gloriosa, Plantago.

    III. The third device to prevent self-pollination is **self-incompatibility.** It is a genetic mechanism that prevents sell-pollen from fertilizing the ovules by preventing pollen germination or pollen tube growth in the pistil. All these methods encourage cross-pollination thus causing genetic variations among them.

OR



Structure of a Mature Embryo Sac: A mature embryo sac is a 7-celled structure and has 8 nuclei. The end near the micropyle is called the micropylar end while the opposite end is called the chalazal end. Following are the main parts of the embryo sac:

Egg Apparatus: The egg apparatus is composed of two synergids and an egg. There are special thickenings at the micropylar end of synergids. These thickenings are called filiform apparatus.

The function of Synergids: The synergids provide a channel to the pollen tube to enter through the filiform apparatus.

Polar Nuclei: The two nuclei enclosed in the central cell are called polar nuclei.

Antipodals: The three cells at the chalazal end are called antipodals.

32. Applications of Recombinant DNA Technology are as follows:
    i. **Study of Molecular Events:** The technology is used in the study of molecular events of various development stages like cellular differentiation, morphogenesis, ageing, etc.
    ii. **Gene Maps:** Recombinant DNA technology can be employed to make gene maps.
    iii. **Development Stages:** A development stage can be stopped, delayed or quickened through manipulation of genes. Mutation of ageing genes in roundworms has shown an increase in the life of the animals by four times.
    iv. **Antisense Therapy:** Extra-activity of genes of a particular region can be checked by introducing specific DNA fragments. The treatment is called antisense therapy.
    v. **Foods with Extra Biochemicals:** With the help of *Agrobacterium tumefaciens* and

viruses, genes for synthesis of various biochemicals can be introduced in plants e.g., Bananas producing vaccines.

vi. **Study of Defective Genes:** The technique can be used in the study of defective genes in the foetus stage.

vii. **Tailor-Made Organisms:** Useful plants, animals and microbes can be tailor-made to suit varied human needs.

viii. **Medical Diagnosis of Diseases:** Short segments of single-stranded DNA with attached fluorescent or radioactive marker are being used as probes for identification of infectious diseases like hepatitis, HIV, cystic fibrosis, muscular dystrophy, etc.

OR

i. (A) Denaturation, (B) Annealing, (C) *Thermus aquaticus*.

ii. **Denaturation:** Heat denatures DNA to separate complementary strands.
Annealing: Primers hybridizes to the denatured DNA strands.
Thermus aquaticus: This enzyme induces denaturation of double-stranded DNA at high temperature.
Extension: Extension of primers resulting in the synthesis of copies of the target DNA sequence.

iii. Enzyme Taq polymerase is isolated from the bacterium *Thermus aquaticus*. The function of Taq DNA polymerase in PCR reaction is to amplify the DNA for the production of multiple copies of it. Taq DNA **polymerase** is a thermostable DNA polymerase which can even work at a higher temperature.

33. i. Population density means a number of individuals present per unit area, population density can be measured by determining the population size.
Ecologists are interested in measuring population density for the following reasons:
   a. The size of the population tells us a lot about its status in the habitat.
   b. Ecological processes such as the outcome of competition with another species, the impact of a predator or the effect of pesticide application can be easily evaluated in terms of change in the population size.

ii. The different methods to study population size are as follows:
   a. **Percent cover or Biomass:** In an area with 200 Parthenium plants and only one banyan tree with a large canopy, the density of banyan tree is small but does not reflect its important role in the community. Here the percent cover or biomass is a

more meaningful method of assessing population density.

b. **Total number:** It involves the counting of organisms in the given area.
c. **Relative density:** In this method, there is no need to count the organisms individually. Example, the number of fishes caught per trap gives the measure of their total density m a given waterbody.
d. **Indirect assessment:** The tiger census is based on pugmarks and faecal pellets.

OR

Range of tolerance: Biological species can show a range of tolerance to the various environmental factors. These factors show variation in their effects and anyone which is present in the least amount may become limiting. The response of an organism to a range of gradient of a single environmental factor such as temperature, sunlight or nutrient concentration forms a bell-shaped curve as shown in the following figure: