CBSE Class 12 Biology

Sample Paper 06 (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. When and where do chorionic villi appear in humans? State their function.
2. For what nucleopolyhydro viruses are being used nowadays?
3. What is aneuploidy?
4. Give the term for prenatal diagnostic technique aimed to know the sex of developing foetus and to detect congenital disorders.
5. Name the two basic amino acids that provide positive charges to histone proteins.
6. Write two uses of chlorine?
7. What are **true-breeding lines** that are used to study the inheritance pattern of traits in plants?
8. How does the moderate and high dosage of cocaine affect the human body?
9. Why is tropical environment able to support greater species diversity?
10. Which bacterium has been used as a clot buster? What is its mode of action.
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:** Each spermatogonium is diploid and contains 46 chromosomes.
Reason: Some spermatogonia, primary spermatocytes complete the meiotic division to form four haploid cells.
    a. The assertion is correct but the reason is incorrect
    b. Both assertion and reason are correct
    c. Both assertion and reason are incorrect
    d. Assertion is incorrect but reason is correct
14. **Assertion:** ELISA is based on the principle of antigen-antibody interaction.
Reason: Infection by a pathogen can be detected by the presence of antigens or by detecting the antibodies synthesized.

a. Both assertion and reason are corrected
b. Assertion is correct but reason is incorrect
c. Assertion and reason is correct but do not explain the assertion
d. Assertion and reason both are incorrect

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

Humans are sexually reproducing and viviparous it involves male and female reproductive systems. The male reproductive system is located in the pelvis region. It includes a pair of testis along with accessory ducts, glands and the external genitalia. The testes are situated outside the abdominal cavity within a pouch called the scrotum. The testis is covered by a dense covering. Each testis has about 250 compartments. Each lobule contains one to three highly coiled seminiferous tubules in which sperms are produced. Each seminiferous tubule is lined on its inside by two types of cells. The regions outside the seminiferous tubules called interstitial spaces contain small blood vessels. Seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leave the testis and open into epididymis located along the posterior surface of each testis.

i. The vas deferens receives duct from the seminal vesicle and opens into the urethra as
   a. epididymis
   b. ejaculatory duct
   c. efferent ductule
   d. ureter

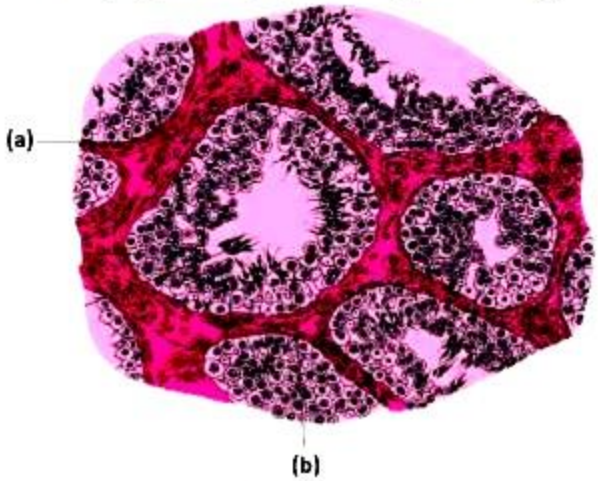
ii. Which one of the following is not a male accessory gland?
   a. Seminal vesicle
   b. Ampulla
   c. Prostate
   d. Bulbourethral gland

iii. The temperature of the scrotum which is necessary for the functioning of the testis is always _____ around below body temperature.
   a. 2-2.5°C
   b. 4-5°C
   c. 6-6.5°C
   d. 7-8°C

iv. The nutritive cells found in seminiferous tubules are

a. Leydig's cells
b. Male germ cells
c. Sertoli cells
d. Chromaffin cells.

v. Identify (a) and (b) in the given image.



a. a - Sertoli cell, b - interstitial cell
b. a - interstitial cell, b - spermatogonia
c. a - spermatozoa, b - Sertoli cell
d. a - spermatozoa, b - spermatogonia

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

Large quantities of wastewater are generated every day in cities and towns. A major component of this wastewater is human excreta. This municipal waste-water is also called sewage. It contains large amounts of organic matter and microbes. Treatment of wastewater is done by the heterotrophic microbes naturally present in the sewage. This treatment is carried out in two stages: Primary treatment which basically involves the physical removal of particles large and small from the sewage and Secondary treatment or Biological treatment. The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and the air is pumped into it. While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD (biochemical oxygen demand) of the effluent.

i. Wastewater treatment generates a large quantity of sludge, which can be treated by
a. anaerobic digesters
b. floe
c. chemicals
d. oxidation pond

ii. The primary treatment of wastewater involves the removal of
   a. dissolved impurities
   b. stable particles
   c. toxic substances
   d. harmful bacteria

iii. BOD of wastewater is estimated by measuring the amount of
   a. total organic matter
   b. biodegradable organic matter
   c. oxygen evolution
   d. oxygen consumption

iv. _____ is the first step of sewage treatment.
   a. Precipitation
   b. Chlorination
   c. Sedimentation
   d. Aeration

v. **Assertion-** the masses of bacteria held together by slime and fungal filaments to form mesh-like structures are called as floes

   Reason- BOD refers to the amount of oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria
   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. Our Assertion is true but the Reason is false
   d. Both the statements are false

Section B

17. In the table given below, select and enter one correct device out of the following: Oral pill, Condom, Copper T, Saheli, Vasectomy, Diaphragm, Tubectomy, Cervical cap

Method of Birth Control	**Device**
1. Barrier	
2. IUD	
3. Surgical Technique	

4. Administering Hormones	

18. What is non-disjunction? Name the different types.
19. Name some techniques used for early molecular diagnosis of pathogens and genetic disorders.
20. Mention the cause and the body system affected by ADA deficiency in humans.

OR

What are transgenic plants? Give some example.

21. If the sequence of one strand of DNA is written as follows: 5' - ATGCATGCATGCATGCATGCATGC -3' Write down the sequence of complementary strand in 5' - 3' direction.
22. How many basic steps are found in genetically modifying organism?

OR

Why is 'plasmid' an important tool in biotechnology experiments?

23. State the use of biodiversity in modern agriculture.
24. In a pond, there were 20 Hydrilla plants. Through reproduction 10 new Hydrilla plants were added in a year. Calculate the birth rate of the population.
25. List any two major causes other than anthropogenic causes of the loss of biodiversity.

Section C

26. The Biology teacher asked the students to verify the experiment on Transformation principle in bacteria to establish DNA as genetic material. The class was divided into two groups. The teacher asked them to submit the reports. Group 2 did not use the mouse and did not repeat Griffith's experiment. The teacher praised them.
    i. What values did the Group 2 exhibit?
    ii. Which experiment did they perform? Explain in brief.
27. How did Griffith explain the transformation of R-strain (non-virulent) bacteria into S-strain (virulent)?
28. What are the Properties of cancer cells?
29. Describe the functions of a gene.
30. Anand a 14yr old boy thinks smoking makes him more energetic and feel like adult and thus more responsible citizen. He tries to smoke when he is with his peer group. As a

friend you have to educate him:

- Why he feels more energetic while smoking?
- Effects of CO in smoke
- Other ill effects on body

OR

Name the parasite that causes filariasis in humans. Mention its two diagnostic symptoms. How is this disease transmitted to other?

Section D

31. Explain the development of the zygote into an embryo and of the primary endospermic nucleus into an endosperm in a fertilised embryo sac of a dicot plant.

OR

i. When we squeeze a seed of an orange, many embryos, instead of one are observed. Explain, how it is possible.
ii. Are these embryos genetically similar or different? Comment.

32. How and why is the bacterium *Thermus aquaticus* employed in recombinant DNA technology? Explain.

OR

What is genetic engineering? Explain in the correct sequence the steps involved in recombinant DNA technology to produce a genetically modified cell.

33. Write short notes on
    i. Protoco-operation
    ii. Mutualism. Give one example in each case.

OR

a. What does an ecological pyramid represent? State any two limitations that these pyramids have.
b. Describe an inverted pyramid of biomass with the help of an example.

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Solution

Section A

1. After implantation, finger-like projections appear on the trophoblast called chorionic villi. It interdigitates with uterine tissue to form placenta.
2. Nucleopolyhydro viruses are used for controlling pests and other arthropods in farms. These are narrow spectrum viruses and do not harm plants, cattle and humans or even on non-target insects.
3. Non separation of chromosomes during meiosis is called non-disjunction. It may result in less or more number of chromosomes. This condition is called aneuploidy.
4. Amniocentesis.
5. Lysine and arginine are the two basic amino acids that provide positive charges to histone proteins.
6. Chlorine is used for
   a)Bleaching wood pulp, cotton and textiles
   b)Manufacturing dyes, drugs, refrigerants etc.
   c)Sterilizing drinking water.
7. True-breeding lines are those plants, which have undergone continuous self-pollination and show stable trait inheritance and expression for several generations.
8. Its moderate dose produces a sense of euphoria and increased energy while high dose causes hallucination.
9. Tropical latitudes have remained undisturbed for millions of years and had a long evolutionary time for species diversification.
   Thus, it supports greater species diversity.
10. Streptococcus is genetically modified to make streptokinase which is used as a clot buster. Streptokinase carries out thrombolysis which breaks the clot into smaller fragments and thus clot is dissolved.
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) The assertion is correct but the reason is incorrect

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

14. (a) Both assertion and reason are corrected

    Explanation: A single-stranded DNA or RNA, tagged with a radioactive molecule (probe) is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography. The clone having the mutated gene will hence not appear on the photographic film, because the probe will not have complementarity with the mutated gene.

    ELISA is based on the principle of antigen-antibody interaction. Infection by a pathogen can be detected by the presence of antigens or by detecting the antibodies synthesized in the body.

15. i. (b) ejaculatory duct
    ii. (b) Ampulla
    iii. (a) 2-2.5°C
    iv. (c) Sertoli cell
    v. (a) a - Sertoli cell, b - interstitial cell

16. i. (a) anaerobic digesters

ii. (b) stable particles

iii. (c) oxygen consumption

iv. (d) Sedimentation

v. (b) Both Assertion and Reason are true but Reason is not the correct explanation of the Assertion

Section B

17.

Method of Birth Control	Device
1. Barrier -	Condom, Diaphragm, Cervical cap
2. IUD -	Copper T
3. Surgical Technique -	Vasectomy, Tubectomy
4. Hormonal administrations -	Oral pill, Saheli.

18. Failure of the synapsed homologous chromosome to separate during anaphase I of meiosis is called non-disjunction. It is of two sub-types:
    a. **Primary non-disjunction:** Non-separation of synapsed chromosomes that occurs in meiocytes.
    b. **Secondary non-disjunction:** Occurrence of non-separated chromosomes in the progeny due to the previous non-disjunction.
19. Recombinant DNA technology, polymerase chain reaction (PCR) and enzyme Linked Immuno Sorbent Assay (ELISA).
20. Adenosine deaminase deficiency is caused by changes (mutations) in the ADA gene . This gene encodes an enzyme that is found in the lymphocytes (specialized white blood cells), which are an important part of the immune system and help protect the body from infections.

    It affects the immune system of our body

    OR

    Transgenic plants are plants that have been genetically engineered, a breeding approach that uses recombinant DNA techniques to create plants with new characteristics.They are identified as a class of genetically modified organism (GMO).

    Examples - Bt Cotton, Golden Rice, Flavr Savr tomato.

21. Sequence of the complementary strand in 3' - 5' direction.

    3' - TACGTACGTACGTACGTACGTACGTACG -5'

    The sequence of complementary strand in 5' - 3' direction will be reverse of above sequence

    5' - GCATGCATGCATGCATGCATGCATCAT-3'

22. There are three basic steps, which are involved in genetically modifying organism.
    i. Identification of DNA with desirable genes.
    ii. Introduction of the identified DNA into the host with or without vector.
    iii. Maintenance of introduced DNA in the host and transfer of the DNA to its progeny.

OR

Plasmid have the ability to replicate within bacterial cells independent of chromosomal DNA. They have high copy number, therefore an alien DNA ligated to it, will have equal copy number as that of plasmids. So, it is used as a vector in gene cloning experiments and thus acts as an important tool in biotechnology.

23. Biodiversity is a source of hybrids, GM plants, biopesticides, organic farming, biofertiliser, improved varieties of plants, disease resistant plants. It also promotes sustainable management of agricultural resources, conservation, and farming of all wild and native varieties of plants, etc.
24. Birth rate

$$\frac{\text{Number of individual s added}}{\text{Initial population}}$$

    new plants per Hydrilla plant per year

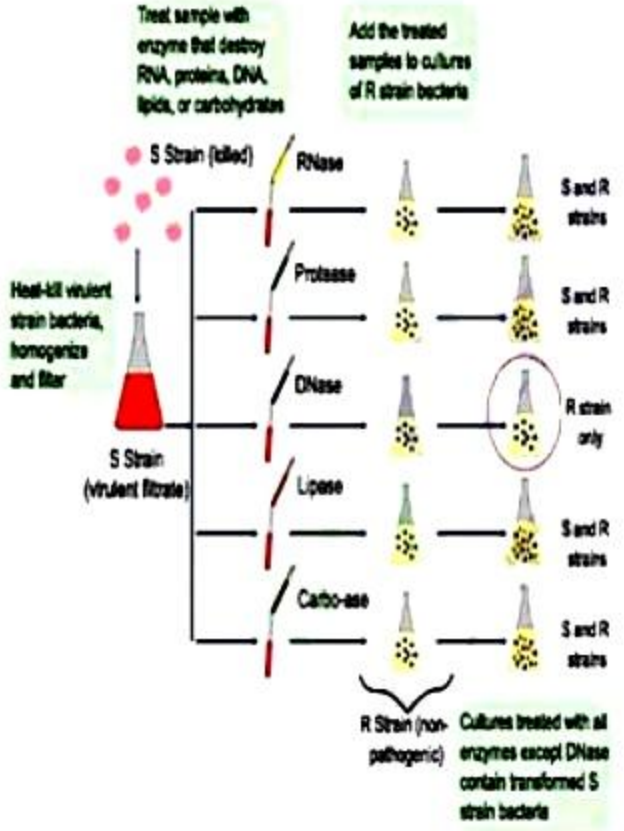
25. Two major causes other than anthropogenic causes) for the loss of biodiversity are as follows:
    i. **Habitat loss and fragmentation** - Loss of habitat causes the extinction of a large number of biodiversity. The degradation of many habitats by pollution also threatens the survival of many species.
    ii. **Over-exploitation** - When we harbour more resources than the capability of biodiversity, it causes the extinction of biodiversity.

Section C

26. i. Scientific attitude, awareness and love for animals and respect towards government policies.

ii. The students repeated the experiment performed by Oswald Avery, Colin MacLeod and Maclyn McCarty (1933-44), who worked to determine the biochemical nature of 'transforming principle' in Griffith's experiment. They purified biochemicals (proteins, DNA, RNA, etc.) from the heat-killed S cells to see which ones could transform live R cells into S cells. They discovered that DNA alone from S bacteria caused R bacteria to become transformed. They also discovered that protein-digesting enzymes (proteases) and RNA-digesting enzymes (RNases) did not affect transformation, so the transforming substance was not a protein or RNA. Digestion with DNase did inhibit transformation, suggesting that the DNA caused the transformation.

Follow the diagram below.



27. influenza pandemic after World War I, by using two strains of the Streptococcus pneumoniae bacterium. The smooth strain (S strain) had a polysaccharide capsule and was virulent when injected, causing pneumonia and killing mice in a day or two. The capsule is a slimy on the cell's surface that allows the bacteria to resist the human immune system. The rough strain (R strain) did not cause pneumonia when injected into mice (it was avirulent) since it lacked a capsule. When the virulent S strain was heated to

kill it, and then injected into mice, it produced no ill effects. However, when dead S strain mixed with live R strain was injected into the mouse, the R/S mouse died. Griffith Observations: After isolating bacteria from the blood of the R/S mice, Griffith discovered that the previously a virulent R bacteria had acquired capsules. The bacteria isolated from the mice infected with the mixture of live type II R and heat killed type III S were now all of the type III S strain, and maintained this phenotype over many generations. Griffith hypothesized that some "transforming principle" from the heat killed type III S strain converted the type II R strain into the virulent type III S strain.

28. The Properties of cancer cells are:
    i. Uncontrolled proliferative ability.
    ii. Extracellular growth factors not required.
    iii. Overgrowth and ability to invade distant new sites i.e. metastasis.
    iv. The nucleus becomes irregular with abundant granules.
    v. Increased number of lysosomes, reduction in mitochondrial cristae, more melanin and debris in the cytoplasm.
    vi. Resist induction of cell death, resulting in the development of tumors.
29. Genes play an important role in the inheritance of characters. Some of their main contributions are listed below:
    i. They are units of inheritance.
    ii. Genes code for proteins, structural as well as functional, to control the phenotype of an organism.
    iii. Genes code for RNAs which are essential for protein synthesis.
    iv. Genes regulate transcription to generate proteins as and when required in the cells.
    v. The recombination process at the time of sexual reproduction produces variations in genes thus in genotype and phenotype.
    vi. Variation in the genetic composition helps in evolution.
30. i) He fells energetic because nicotine raises blood pressure and increases heart beat. This is not good for his health.
    ii) CO binds to hemoglobin and reduces concentration of oxygen
    iii) Any one effort cancer of lung, throat, emphysema.

    Values

    • Awareness about health

    • Consciousness.

• Critical thinking.

OR

Pathogens of filariasis: *Wuchereria bancrofti* and *W. malayi*
Diagnostic symptoms:

i. Inflammation of the organs in which the parasite resides especially lower limbs lymphatic vessels.
ii. Genital organs are also affected.

Transmission: Pathogens are transmitted to a healthy person through the bite by the female mosquito vectors.

Section D

31. i. **Development of Endosperm**
    a. **In nuclear type,** which is a common method the Primary Endosperm Nucleus (PEN) undergoes repeated mitotic division without cytokinesis. At this stage, the endosperm is called free nuclear endosperm.
    b. **In cellular type,** cell wall formation occurs and the endosperm becomes cellular. The number of free nuclei formed before cellularisation varies greatly, e.g. in coconut the water is free nuclear endosperm and surrounding white kernel is cellular endosperm.
    c. **In helobial type** endosperm formation, one half of endosperm is nuclear type and the other half is cellular type.

ii. **Embryo Development in Dicot Plant**
    a. Embryo formation starts after a certain amount of endosperm is formed.
    b. The zygote divides by mitosis to form a proembryo.
    c. Formation of the globular and heart-shaped embryo occurs, which finally becomes a horseshoe-shaped mature embryo.
    d. In dicot plant, the embryo consists of two cotyledons and an embryonal axis between them.
    e. The portion of the embryonal axis above the level of attachment of cotyledons is epicotyl and terminates in the plumule.
    f. The portion of the embryonal axis below the level of attachment of cotyledon is the hypocotyl, it becomes radicle (root tip).

OR

i. It is true that when we squeeze a seed of an orange, many embryos, instead of one are observed. It occurs mainly due to a process called **polyembryony**.
It is a phenomenon of occurrence of more than one embryo in a seed. It was first described by Antony van Leeuwenhoek (1719) in Citrus.
Polyembryony can be spontaneous or induced experimentally. The polyembryony may arise by the following reasons:
   a. Formation of additional embryos from synergids or from antipodals and polar nuclei (very rare).
   b. Some embryos can also be derived by the activation of some sporophytic cells of ovule such as nucellus or integument.
   c. Embryos can also be developed from an additional embryo sac in the same ovule.

ii. The embryos formed as a result of polyembryony are genetically similar to one another. However, the embryos arising from gametophytic tissues are similar to each other, but not to their parents. The embryos that are derived from sporophytic tissues are usually similar to each other as well as their parents.

32. The bacterium *Thermus aquaticus* is employed and used for amplification of the gene of interest using PCR technique.
Usually Taq (*Thermus aquaticus*) DNA polymerase, a thermostable enzyme is isolated from a thermophilic bacterium. The enzyme extends the two primers towards each other in order to copy the DNA segment (act as a template) lying between the two primers.
The step requires the presence of deoxynucleoside triphosphates and Mg^{2+} and occurs at 72°C.
If these cycles are repeated many times, the DNA segment can be amplified to approximately a billion times the DNA segment are made.

i. These are restriction endonucleases enzymes which cut the DNA molecule at the specific base sequences into fragments with sticky ends.
e.g., Eco RI, Hind II

ii. The enzyme restriction endonuclease cleaves DNA at a specific site resulting in the formation of fragments with single strand portions at the ends called sticky-ends. In practice, the digestion by the restriction enzyme keeping all other conditions at the optimum level and checked by using agarose gel electrophoresis technique.

OR

Genetic engineering is the technique of altering the nature of DNA and RNA and/or the introduction of it into a host organism and thus changing the phenotype of the organism. The technique of genetic engineering include:

i. Creation of recombinant DNA/Recombinant DNA technology: It involves
   a. Isolation of DNA from bacterial cells/plant or animal cells by using enzymes such as lysozyme, cellulase and chitinase. DNA is a collection of fine threads in the suspension.
   b. Fragmentation of DNA is carried out by restriction enzymes. A similar process is repeated with vector (Plasmid, phage) DNA.
   c. DNA segments are separated and isolated by the technique of gel-electrophoresis,
   d. Isolated desired DNA fragment or copy of the amplified gene of interest (PCR technique) and the cut vector with space are mixed and ligase enzyme is added.

ii. Formation of r-DNA by cloning of alien DNA and vector DNA. (Ligation of DNA fragment into a vector)

iii. Transfer of r-DNA into the host by
   a. Making the host competent to take in DNA
   b. Micro-injection
   c. Biolistic or gene gun
   d. disarmed pathogen vectors which when allowed to infect the cell, transfer the r-DNA into the host. As a result of this technique, a genetically modified cell is produced.

33. i. **Protoco-operation:** It is an interaction between two different species in which both the members are mutually benefited, but their coexistence is not obligatory for their survival, that is, the two members can also do without each other.
Example: It is a relationship between a tick bird and cattle. The tick bird picks out the ticks from the body of the cattle as its food, and the cattle is relieved of its ectoparasites, the ticks. However, the tick bird and the cattle can survive without each other.

ii. **Mutualism:** It is a symbiotic relationship between the members of two different species in which the two partners are mutually benefited. There is a complete physiological dependence of the partners on each other, and one cannot survive in the absence of the other. Sometimes the term symbiosis is used as synonym with

mutualism.

Example: Symbiotic bacteria like Ruminococcus are found in the rumen part of the compound stomach of cud-chewing mammals like cattle, sheep, goat, camel, etc. and secrete cellulase enzyme to digest the cellulose of plant food eaten by the ruminants which provide food and shelter to the bacteria.

OR

a. Ecological pyramids represent the relationship between different trophic levels in terms of number, biomass and energy.

Limitations of the ecological pyramid are-

(i) It does not take into account the same species belonging to two or more trophic levels.

(ii) It assumes a single food chain which almost never exists in nature.

(iii) It does not accommodate a food web.

(iv) Saprophytes are not given any place even though they play vital role in the ecosystem.

b. The pyramids of biomass in aquatic ecosystem/ sea are generally inverted.

e.g biomass of fishes is much more than the biomass of phytoplankton.