Class: XII
SESSION : 2022-2023
SUBJECT: BIOLOGY (044)
SAMPLE QUESTION PAPER - 2
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. The side effects of the use of anabolic steroids in female: **[1]**

a) Aggressiveness
b) All of these
c) Irregular menses
d) Musculanisation

2. Approximately how much of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis? **[1]**

a) 1-5%
b) Less than 1%
c) 30%
d) 50%

3. What is the method of create awareness among the people about reproduction-related aspects? **[1]**

a) All of these
b) With the help of parents, other close relatives, teachers and friends
c) Introduction of sex education in schools
d) With the help of audio-visual and the print media

4. Which of the following is a rod-shaped virus? **[1]**

a) CMV
b) TMV
c) Bacteriophage
d) All of these

5. The species which may become the endangered category are known as? **[1]**

a) Vulnerable
b) Living fossils
c) Threatened
d) Rare

6. Microbes are also used for commercial and industrial production of certain chemicals like organic acids, alcohols, and enzymes, choose correct statements from given statements. **[1]**

i. Aspergillus niger is a fungus that produces acetic acid.

ii. Acetobacter aceti is a bacterium that produces citric acid.

iii. Clostridium butylicum is a bacterium that produces butyric acid and propionic acid.

iv. Lactobacillus which is a bacterium produces lactic acid and CO_2.

v. Saccharomyces cerevisiae is used for the commercial production of ethanol and CO_2.

vi. Microbes can produce enzymes like lipase, pectinases, and proteases.

a) (iv), (v) and (vi

b) (v) and (vi)

c) All statements are incorrect

d) (i), (ii), (iii), (iv) and (vi)

7. Birds are evolved from: **[1]**

a) Fishes

b) Amphibians

c) Non-chordates

d) Reptiles

8. Inheritance of skin colour in human is an example of: **[1]**

a) Polygenic inheritance

b) Point mutation

c) Co-dominance

d) Chromosomal aberration

9. A patient brought to a hospital with myocardial infarction is normally immediately given: **[1]**

a) Streptokinase

b) Penicillin

c) Cyclosporin–A

d) Statins

10. DNA fingerprinting or genetic finger printing is the process of: **[1]**

a) Matching the fingerprint of different persons.

b) Analyzing VNTR samples of DNA obtained from body fluid or cells.

c) Finding similarities of finger shapes of different individuals.

d) Comparing the DNA of two individuals.

11. Genital warts is a sexually transmitted disease caused by: **[1]**

a) Herpes simplex virus

b) Leptospira

c) Papilloma virus

d) Pasteurella

12. Biotechnology is the modern branch of biology which deals with: **[1]**

a) Genetic engineering

b) All of these

c) Biochemistry

d) Microbiology

13. **Assertion (A):** Beer and wine are called soft liquors while gin, rum, etc. are hard liquors. **[1]**
Reason (R): Beer and wine are made without distillation.

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:** Insertion or deletion of one or two bases cause frame-shift mutation. **[1]**
Reason: Insertion or deletion of one or two bases changes the reading frame from the point of insertion or deletion.

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

15. **Assertion:** Reproductive isolation brings about sympatric speciation **[1]**
Reason: It is the primary mode of speciation e.g. Darwin's finches.

a) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion

b) If both Assertion & Reason are true and the reason is the correct explanation of the assertion

c) If Assertion is true statement but Reason is false

d) If both Assertion and Reason are false statements

16. **Assertion (A):** An incomplete flower can be perfect. **[1]**
Reason (R): Perfect flowers (incomplete) are called neuter.

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.

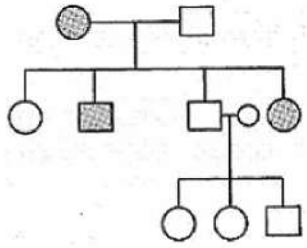
d) A is false but R is true.

Section B

17. Why do sportspersons often fall a victim to cocaine addiction? **[2]**

18. Why cannot E. coli be used to overproduce penicillin? **[2]**

19. In the following pedigree chart, state if the trait is autosomal dominant, autosomal recessive or sex-linked. Give reason. **[2]**



20. What is the key difference between primary and secondary sewage treatment? **[2]**

OR

What are biopesticides? Give the scientific name and the use of the first commercially used biopesticide in the world?

21. A biologist is trying to infer how five closely related species of snakes are related to oneanother. She notices that some of the snakes have forked tongues and others do not. Which of the following would help her distinguish the ancestral state? **[2]**

Section C

22. What is pedigree analysis? Suggest how such an analysis can be useful? **[3]**

23. Trace the succession of plants on a dry bare rock. **[3]**

24. i. List any three ways of measuring population density of a habitat. **[3]**
ii. Mention the essential information that can be obtained by studying the population density of an organism.

25. You find that a lake in your neighboring area has been covered by Water hyacinth. You have contacted your friends to remove this weed. Nobody agrees to support you. How will you explain the necessity of this? **[3]**

OR

Define wildlife. Describe its significance in the maintenance of the environment.

26. How would the gene flow or genetic drift affect the population? Do the population in which gene flow and genetic drift are operated obey Hardy Weinberg principle? **[3]**

27. Highlights five areas, where biotechnology has influenced our lives. **[3]**

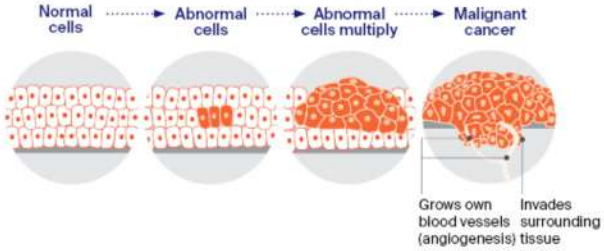
28. Who is a surrogate mother? **[3]**

Section D

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

Cancer is a major burden of disease worldwide. Each year, tens of millions of people are diagnosed with cancer around the world, and more than half of the patients eventually die from it. In many countries, cancer ranks as the second most common cause of death following cardiovascular diseases. With significant improvements in the treatment and prevention of cardiovascular diseases, cancer has

or will soon become the number one killer in many parts of the world.



(i) Cancer is one of the most dreaded diseases. Explain contact inhibition and metastasis with respect to disease.

(ii) Name the group of genes that have been identified in normal cells that could lead to cancer. How do these genes cause cancer?

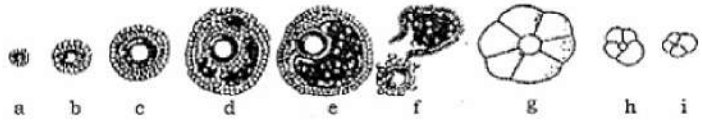
(iii) Name any two techniques that are useful in detecting cancers of internal organs.

OR

Why are cancer patients often given a-interferon as part of the treatment?

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

The following is the illustration of the sequence of ovarian events (a-i) in a human female.



(i) Identify the figure that illustrates ovulation and mentions the stage of oogenesis it represents.

(ii) Name the ovarian hormone and the pituitary hormone that have caused the above-mentioned event.

(iii) Explain changes that occur in the uterus simultaneously in anticipation.

OR

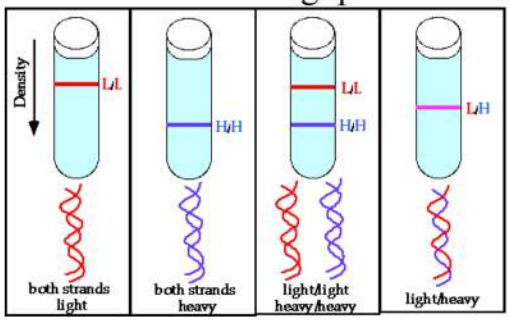
Draw a labelled sketch of the structure of a human ovum prior to fertilization.

Section E

31. Differentiate between leading strand and lagging strand. **[5]**

OR

Answer the following questions based on Meselson and Stahl's experiment.



i. Write the name of the chemical substance used as a source of nitrogen in the experiment by them.

ii. How did the scientists make it possible to distinguish the heavy DNA molecule from the light DNA molecule? Explain.

iii. Write the conclusion the scientists arrived at after completing the experiment.

32. i. Mature seeds of legumes are non-albuminous. Then, can it be assumed that double fertilisation does not occur in legumes? Explain your answer. **[5]**

ii. List the differences between the embryos of dicot (pea) and monocot (grass) families.

OR

What develops into a microspore mother cell in a flower? Trace the development of this cell into a pollen grain which is ready for germination. Draw a labelled figure by a mature pollen grain.

33. i. Explain how to find whether an *E.coli* bacterium has transformed or not when a recombinant DNA bearing ampicillin resistant gene is transferred into it. **[5]**

ii. What does the ampicillin resistant gene act as in the above case?

OR

Write a short note on gene transfer.

SOLUTION

Section A

1. **(b)** All of these
   Explanation: Side effects of anabolic steroids specifically in women are acne, hair loss, withdrawal of the frontal hairline, male pattern boldness, lowering of the voice, increased facial hair growth, and breast atrophy. The lowering of the voice, decreased breast size, clitoris hypertrophy and hair loss are generally irreversible. Females using AS (anabolic steroids) may develop masculine facial traits, male muscularity, and coarsening of the skin.
2. **(a)** 1-5%
   Explanation: Plants capture only 2-10 percent of the photosynthetically active radiation (PAR). Hence, 1-5% of the solar energy that falls on the leaves of a plant is converted to chemical energy by photosynthesis.
3. **(a)** All of these
   Explanation: All of these
4. **(b)** TMV
   Explanation: TMV
5. **(a)** Vulnerable
   Explanation: Vulnerable
6. **(b)** (v) and (vi)
   Explanation: Yeast (Saccharomyces cerevisiae) is used for commercial production of ethanol.
7. **(d)** Reptiles
   Explanation: Reptiles
8. **(a)** Polygenic inheritance
   Explanation: Polygenic inheritance
9. **(a)** Streptokinase
   Explanation: The patient suffering from myocardial infarction is immediately given an injection of Streptokinase. Streptokinase is an enzyme secreted by several species of streptococci that can bind and activate plasminogen used as effective and inexpensive thrombolysis medication in some cases of myocardial infarction.
10. **(b)** Analyzing VNTR samples of DNA obtained from body fluid or cells.
    Explanation: VNTR analysis (sometimes called DNA fingerprinting) can be used to identify and match cell samples.
    In order to use VNTRs, we must have a source of DNA. The DNA can come from any nucleated cell, e.g., white blood cells, skin samples, semen samples, or hair follicles. Red blood cells cannot be used as they do not have a nucleus.
    For a VNTR analysis, the DNA is extracted and cut using restriction endonucleases. A Southern Blot is then performed using various probes.
11. **(c)** Papilloma virus
    Explanation: Papilloma virus
12. **(b)** All of these
    Explanation: All of these
13. **(b)** Both A and R are true but R is not the correct explanation of A.
    Explanation: Beer, wine, gin, rum, vodka, etc. are fermentation products but beer and wine are formed without distillation. However, distillation of fermented broth is carried out in case rum, gin, etc. Distillation increases the alcohol concentration of the beverage. Thus,

gin with 40% alcohol, rum with 40% alcohol and brandy with 60-70% alcohol are more alcoholic than beer (3-6% alcohol) and wine (9-12% alcohol).

14. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.
    Explanation: Assertion and reason both are correct statements and reason is correct explanation for assertion.
15. **(a)** If both Assertion & Reason are true but the reason is not the correct explanation of the assertion
    Explanation: Sympatric speciation is the evolution of a new species from a surviving ancestral species while both continue to inhabit the same geographic region. Reproductive isolation brings about sympatric speciation. The mechanisms of reproductive isolation are a collection of evolutionary mechanisms, behaviors, and physiological processes critical for speciation. They prevent members of different species from producing offspring or ensure that any offspring are sterile.
16. **(c)** A is true but R is false.
    Explanation: A flower is regarded as complete if it has all the four floral whorls, i.e., calyx, corolla, androecium and gynoecium. If any of these whorl in missing the flower is described as incomplete. An incomplete flower can either be perfect, having male as well as female sex organs or imperfect with either of the sexes missing. When both the essential organs are absent, the flower is spoken as neuter.

Section B

17. Cocaine has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy, thus enhances the performance of sportsman.
18. Because Penicillin is Intracellular Product, if use we E.Coli to overproduce this intracellular product cause increasing of number of product and cellular weight results metabolic imbalance and physically cell disruption and loss of cells. Penicillin will kill the antibiotic sensitive E.coli cells.
19. Autosomal dominant.
    The defective trait is present in both male and female progeny and the unaffected child did not pass the trait.
20.

	Primary sewage treatment	Secondary sewage treatment
1.	It is a physical method of treatment	It is a biological method of treatment
2.	It involves in removal of large particles and floating materials such as leaves, papers, rags, solids such as sand, grit and oily substances	It involves the removal of fine suspended and dissolved organic matter.
3.	It makes the used of sedimentation and filtration process	It makes the use of aerobic or anaerobic biological units
4.	It is relatively simple and less time consuming process	It is relatively complex and takes a long time for its completion

OR

Biopesticides are those biological agents that are used for control of weeds/ insect pathogens.
- Bascillus thuringiensis (Bt)
- Use: It produces insecticidal cry protein which can kill larvae of certain insects e.g. bollworm

21. She locates a specimen of a more distantly related snake to see if it has a forked tongue. Five closely related species of snakes can be grouped according to ancestral state on the basis of forked tongues. The biologist located a specimen of snake which was distinctly related having forked tongue.

Section C

22. A record of inheritance of certain genetic traits for two or more generations presented in the form of a diagram or family tree is called pedigree. Analysis of traits in a several generation of a family is called as pedigree analysis. It is employed in case of human beings and domesticated animals.

    Importance:

    (i) In human genetics, pedigree study provides a strong tool which is utilised to trace the inheritance of a specific trait, abnormality or disease.

    (ii) It is useful for the genetic counsellors to advice in tending couples about the possibility of having children with genetic defects like haemophilia, colour blindness, alkaptonuria, thalassemia and sickle all anaemic.

23. **Primary succession on rocks:** These are usually lichens which are able to secrete acids to dissolve rock, helping in weathering of rocks and soil formation.

    These later pave way to some very small plants like bryophytes, which are able to take hold in the small amount of soil.

    They are with time succeeded by herbs, shrubs and shrubs succeed in existence by bigger plants, and after several more stages.

    Ultimately a stable climax forest community is formed.

24. i. Three ways of measuring population density of a habitat.
        A- Per cent cover for trees with larger canopy
        B- Number of fishes caught per trap
        C- Pug marks or faecal pellets for tiger census.
    ii. The population density tells us about the status of a species, i.e., the outcome of competition, impact of predation or effect of pesticides, etc.

25. Friends should be explained how water hyacinth can damage the ecosystem of the lake and harm the environment. Excessive growth of such aquatic weeds cause ageing of a lake by mineral enrichment of water (eutrophication) which is harmful to aquatic life.

    Values

    - Problem solving
    - Critical thinking
    - Responsibility
    - Concern for others

    OR

    The wildlife refers to the naturally occurring species of animal, plants, and microorganisms which are not domesticated or cultivated.

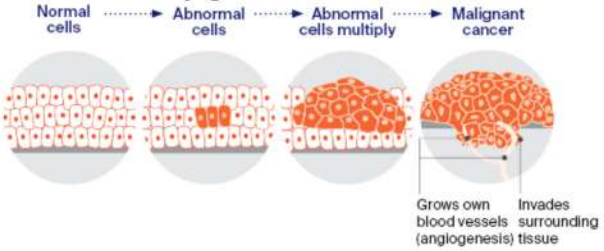
    Significance of wildlife in the maintenance of the environment are as follows:

    i. Wildlife provides links in food chains operating in nature. These food chains are extremely beneficial to us.
    ii. Wildlife maintains a balance in nature, e.g., snakes control rodent population which destroy our crops.
    iii. Wildlife also performs the role of biological control. These help in the recycling of matter in nature
    iv. Green plants purify the air, they give us oxygen that sustains life and also helps to maintain atmospheric temperature,
    v. Plants add water vapour by transpiration and influence the humidity and rainfall.

26. **Gene flow** occurs due to gene migration either emigration or immigration in a population multiple times and it can result in changing the frequency of alleles of a gene within the gene pool of that population. Such population with active gene flow will not obey the Hardy-Weinberg principle.
Genetic Drift is a sudden and by chance change in the frequency of genes and their alleles within a gene pool of a population over a very short duration of time. This type of population will also not obey the Hardy-Weinberg principle.
27. Biotechnology has influenced our lives in the following ways:
    i. It has provided us with genetically modified crops of better quality and high nutrient value.
    ii. It has made available better and safer recombinant vaccines.
    iii. It has helped to develop transgenic animals that can produce human proteins.
    iv. It has enabled gene therapy for curing genetic diseases.
    v. Environment pollution has also been taken care of with the help of genetically engineered microbes.
28. A surrogate mother is a mother who substitutes the real mother to nurse the embryo in her uterus/womb because some women can produce normal ovum but cannot support a full term pregnancy due to physiological and anatomical reasons. Thus, an in-vitro embryo is implanted into the womb of another woman who carries it for the full term of pregnancy and gives birth to a healthy baby.

Section D

29. **Read the text carefully and answer the questions:**
Cancer is a major burden of disease worldwide. Each year, tens of millions of people are diagnosed with cancer around the world, and more than half of the patients eventually die from it. In many countries, cancer ranks as the second most common cause of death following cardiovascular diseases. With significant improvements in the treatment and prevention of cardiovascular diseases, cancer has or will soon become the number one killer in many parts of the world.



(i) Contact inhibition is the property exhibited by normal cells. It prevents their uncontrolled proliferation when they are in contact with other neighbouring cells. But cancerous cells seem to have lost this property and continue to divide despite being in contact with other cells, which leads to masses of cells called tumours. Metastasis is the property exhibited by malignant tumours which grow rapidly, invades neighbouring tissues and is capable of reaching distant sites through blood and lymph thus, spreading malignant tumours to other organs or parts of the body. These two properties make 'cancer' one of the dreaded diseases.

(ii) The group of genes called cellular oncogenes or proto-oncogenes in normal cells could lead to cancer.
These genes are present in inactivated or suppressed form. Some factors, i.e physical, chemical or biological called carcinogens are capable of activating these oncogenes and thus, transforming normal cells into a cancerous one.

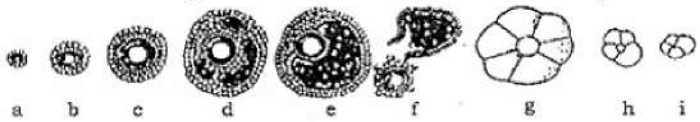
(iii)The two techniques useful m detecting cancers of internal organs are CT (Computed Tomography) and MRI (Magnetic Resonance Imaging).

OR

As tumour cells are capable of avoiding recognition and destruction by the immune system, the cancer patients are given α-interferons which are biological response modifiers. It helps in activating the immune system and destroy tumours.

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

The following is the illustration of the sequence of ovarian events (a-i) in a human female.

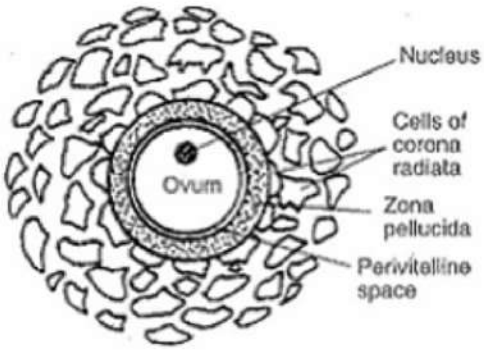


(i) Figure f illustrates ovulation.

(ii) It represents secondary oocyte stage of oogenesis.
-Pituitary hormone -LH

(iii)Endometrium proliferates and becomes thicker by rapid cell multiplication development and maturation of ovum is in progress, while the figure 'h' shows that corpus luteum going towards degeneration.

OR



Section E

31.

Leading strand	Lagging strand
1. It is a replicated strand of DNA which grows continuously without any gap.	1. The lagging strand is a replicated strand of DNA which is formed in short segments called discontinuous.
2. It does not require DNA ligase for its growth	2. DNA ligase is required for joining okazaki fragments.
3. The direction of growth of a leading strand is 5' $\rightarrow$ 3'	3. The direction of the lagging strand is 3' $\rightarrow$ 5'
4. Only a single RNA primer is required	4. Starting of each okazaki fragment requires a new RNA.
5. Its template opens in 3' $\rightarrow$ 5' direction	5. Its template opens in 5' $\rightarrow$ 3' direction
6. Formation of leading strand begins immediately at the beginning of replication.	6. Formation of lagging strand begins a bit later than that of leading strand.

OR

i. NH_4Cl (ammonium chloride).

ii. The heavy and light DNA molecules can be differentiated by centrifugation in a cesium chloride (CsCl) density gradient. The ^{15}N-DNA was heavier than ^{14}N-DNA and the hybrid ^{15}N - ^{14}N -DNA had density intermediate of the two.

iii. Scientists concluded that the DNA replication is semiconservative, i.e. of the two strands of DNA, one is the parental strand, while another is newly synthesised.

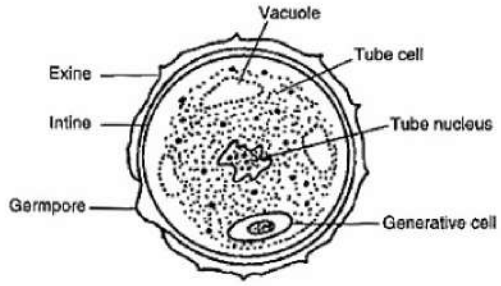
32. i. Seeds of legumes are non-albuminous that implies that endosperm in such seeds is completely used up in providing nutrition to developing the embryo. The endosperm is formed as a result of triploid fusion, i.e. between a male gamete and two polar nuclei. This making it obvious that it cannot be formed in the absence of double fertilization. Therefore, though the seeds of legumes are non-albuminous, it clearly states the occurrence of double fertilization in them.

ii. The differences between the embryos of pea and grass can be summarised as follows

Dicot embryo (Pea)	Monocot embryo (Grass)
The basal cell forms a 6-10 celled suspension.	Basal cell produces a single-celled suspension.
The terminal cell produces an embryo, except the radicle.	Forms the whole of the embryo.
The first division of terminal cell is longitudinal	The first division is transverse.
It possesses two cotyledons.	It possesses one cotyledon.
Plumule is terminal and is present between the elongated cotyledons.	Plumule is laterally present to excessive growth of single cotyledon.

OR

Sporogenous cell divide and ultimately transformed into microspore mother cells. Microspore mother cells develop an internal layer of callose which breaks the plasmodesmal connections among themselves. The separated mother cells round off and undergo meiosis to produce tetrads of haploid microspores or pollen grains.



Section of a mature pollen grain

33. i. When an *E.coli* bacterium is transformed with a recombinant DNA bearing ampicillin-resistant gene in its plasmid, the recombinant plasmid will lose tetracycline resistance due to the insertion of foreign DNA but can still be selected out from non-recombinant ones by plating the transformants on ampicillin containing a medium. The transformants growing on ampicillin containing medium are then transferred to a medium containing tetracycline. The recombinants will grow on ampicillin containing medium but not one that containing tetracycline. But non-recombinant will grow on the medium containing both the antibiotics.

ii. In this case, one antibiotic gene helps in selecting the transformants whereas the other antibiotic resistance gene gets inactivated due to the insertion of alien DNA and helps in

the selection of recombinants. Ampicillin resistant gene in the above case helps in selecting the transformants and act as a selectable marker.

OR

It is carried out by two methods, vector transfer and direct transfer.

i. Vector Transfer: rDNA is present in the form of plasmid, virus, cosmid or artificial chromosome. It is introduced into the host cell by adding it into the culture of plasmid-free bacteria or animal cells. The host cells are made permeable through electroporation or chemically through calcium chloride, calcium phosphate, polyethylene glycol or dextran sulphate. Once inside the host cell, the recombinant DNA begins to multiply and form the desired product.

ii. Direct or Vectorless Transfer: The desired gene, as well as recombinant DNA, can be passed into the plant, animal or human cells through
    1. Microinjection by means of micro-pipettes and
    2. Particle or gene gun where tungsten or gold particles coated with desired genes are bombarded into the cells with great force. Instead, special sprays are also used for this.