19. How is DNA isolated in purified form from a bacterial cell? **CBSE 2025**

Ans. DNA is isolated by breaking up the bacterial cells using lysozyme (to digest the cell wall), RNA and proteins are removed by treating with ribonuclease and protease, respectively. Purified DNA is then precipitated by adding chilled ethanol and collected by spooling.

20. Observe the given sequence of nitrogenous bases on a DNA fragment and answer the following questions.

5′-CAGAATTCTTA-3′

3′-GTCTTAAGAAT-5′

(i) Name the restriction enzyme, which can recognise the DNA sequence.

(ii) Write the sequence after restriction enzyme cut the palindrome.

(iii) Why are the ends generated after digestion called as 'sticky ends'? **CBSE 2025**

2 Marks Questions

18. The basic scheme of the essential steps involved in the process of recombinant DNA technology is summarised below in the form of a flow diagram. Study the given flow diagram and answer the questions that follow.

Step-1 Plasmid DNA (cut using restriction enzyme *Eco* RI) + Foreign DNA (cut using restriction enzyme *Eco* RI)

↓ DNA ligase

Step-2 Recombinant DNA molecule

↓

Step-3 Transfer of recombinant DNA molecule to the host cell

↓

Step-4 Replication of recombinant DNA molecule in the host cell

(i) Name the specific enzyme that might have been used to make the multiple copies of foreign DNA before undergoing step-1 of the process.

(ii) How does the use of restriction enzyme *Eco* RI in Step-1 facilitate the action of DNA ligase to form the recombinant DNA molecule? Explain.

(iii) Name the most commonly used host in the above process.

CBSE 2025

12. Name the commonly used vector for cloning genes into higher organisms. **CBSE SQP 2021-22**

Ans. The commonly used vectors for cloning genes into higher organisms are retrovirus, bacteriophage, etc.

13. What is the cell that receives a recombinant gene called? **All India 2019**

Ans. Host cell is the cell that receives a recombinant gene.

14. Write the specific point in the palindrome and the bond that is cut by *Eco* Rl. **All India 2019**

Ans. Restriction endonuclease *Eco* Rl cuts the DNA at the sequence known as palindromic sequence, i.e. GAATTC. The type of bond broken by *Eco* RI is phosphodiester bond between the G and A bases of the palindrome. This site is known as restriction site.

15. Write the two components of the first artificial recombinant DNA molecule constructed by Cohen and Boyer. **CBSE SQP 2018**

Assertion-Reason Type Question

6. Assertion (A) Synthetic oligonucleotide polymers are used during annealing in a PCR.

Reason (R) The primers bind to the double-stranded DNA at their complementary regions. **CBSE 2023**

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion

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

(c) Assertion is true, but Reason is false

(d) Assertion is false, but Reason is true

Ans. (c) Assertion is true, but Reason is false. Reason can be corrected as

The primers binds to the single-stranded DNA at their complementary regions.

7. A biotechnologist wanted to create a colony of *E. coli* possessing the plasmid pBR322, sensitive to tetracycline. Which one of the following restriction sites would he use to ligate a foreign DNA? **CBSE SQP 2020**

(a) *Sal* I
(b) *Pvu* I
(c) *Eco* RI
(d) *Hin*d III

Ans. (a) *Sal* I **(1)**

Assertion-Reason Type Questions

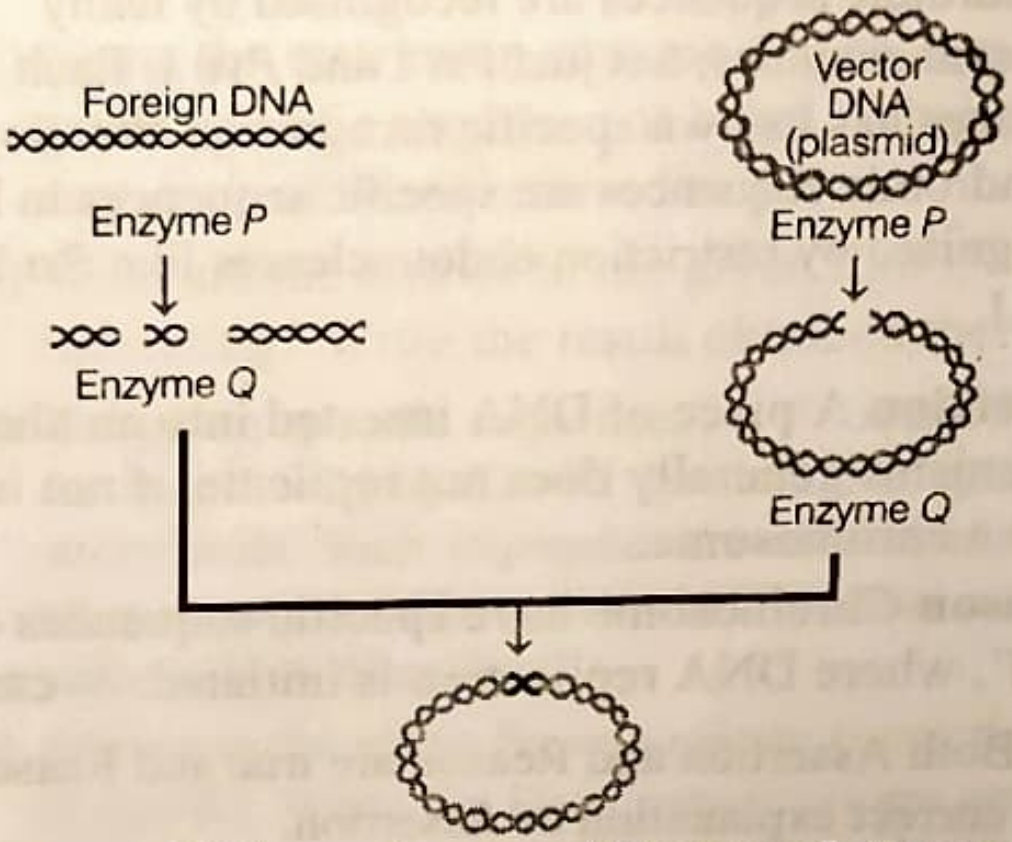
Direction *(Q. Nos. 8-11) consist of two statements Assertion and Reason. Answer these questions by selecting the appropriate option given below*

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion
(b) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion
(c) Assertion is true, but Reason is false
(d) Assertion is false, but Reason is true

8. **Assertion** (A) Restriction endonuclease recognises palindromic sequence in DNA and cuts them.

Reason (R) Palindromic sequence has two unique recognition sites *Pst* I and *Pvu* I recognised by restriction endonuclease. **CBSE 2025**

6. Name the enzymes *P* and *Q* that are involved in the processes given below.



(a) Enzyme *P*–Exonuclease and Enzyme *Q*–Permease

(b) Enzyme *P*–Exonuclease and Enzyme *Q*–Ligase

(c) Enzyme *P*–Endonuclease and Enzyme *Q*–Permease

(d) Enzyme *P*–Restriction endonuclease and Enzyme *Q*–Ligase **CBSE SQP 2020**

ns. (d) *P* enzyme is restriction endonuclease and *Q* enzyme is ligase. **(1)**

1 Mark Questions

1. Isolation of DNA from a fungal cell can be achieved by using **CBSE 2025**

(a) cellulose
(b) chitinase
(c) lysozyme
(d) protease

Ans. (b) chitinase

2. Select the correct statement from the following biotechnological procedures. **CBSE 2025**

(a) The polymerase enzyme joins the gene of interest and the vector DNA
(b) Gel electrophoresis is used for amplification of a DNA segment
(c) PCR is used for isolation and separation of gene of interest
(d) Plasmid DNA acts as vector to transfer the piece of DNA attached to it

Ans. (d) Statement (d) is correct. Statements a, b and c are incorrect. They can be corrected as

Polymerase enzyme add nucleotides during DNA synthesis, but it does not join the DNA fragment.

Gel electrophoresis is used to separate DNA fragments size based an their.

PCR is used to amplification of a gene.

3. Identify the incorrect statement regarding PCR.

CBSE 2025

(a) Two sets of primers are required during polymerisation

(b) The process of replication is repeated multiple times to produce one billion copies

(c) Thermostable DNA polymerase is used for extension of primers

(d) Annealing is required to separate both the strands of template DNA

Ans. (d) Statement (d) is incorrect. It can be corrected as Annealing is the step, where two single-stranded DNA molecules bind to each other by forming hydrogen bonds.

4. Using a DNA template, how many new DNA molecules would be generated after 10 cycles of amplification in PCR?

CBSE 2024 (Set-I)

(a) 512 (b) 1024 (c) 2048 (d) 256

5. Which one of the following enzymes, a fungal cell should be treated with to get the DNA along with other macromolecules released from it?

CBSE 2024 (Set-II)

(a) Isozymes
(b) Cellulose
(c) Ribonuclease
(d) Chitinase

Ans. (d) A fungal cell should be treated with chitinase to get the DNA out along with other macromolecules such as RNA, proteins, polysaccharides and also lipids released from it.

Multiple Choice Questions

1. Out of the following, select the correct match. **CBSE 2025**

(a) Transgenic cow milk–Human beta-lactalbumin protein

(b) ELISA–Antigen-antibody interaction.

(c) Corn borer–*cry* II Ab gene

(d) Cotton plant–*Meloidogyne incognita*

Ans. (b) ELISA—Antigen-antibody interaction

Option a, c, and d are incorrect match,they can be corrected as

Trangenic cow milk-Human alpha-lactalbumin protein

Corn borer-*cry* I Ab gene

Tobacco plant-*Meloidogyne incognita*

2. Crystals of *Bt* toxin produced by some bacteria do not kill the bacteria producing them because **CBSE 2024C**

(a) bacteria are resistant to the toxin

(b) toxin is immature

(c) toxin is inactive

(d) bacteria encloses 'toxin' in a special capsule

Ans. (c) Toxin is inactive

Bt toxin is produced as a protoxin (inactive form) in bacteria, which becomes active only in the alkaline gut of insects.

3. The specific *Bt* toxin genes which protect the cotton plants against the cotton bollworms are **CBSE 2024 (Set-I)**

(a) *cry* I Ac and *cry* II Ab

(b) *cry* I Ab and *cry* I Bc

(c) *cry* II Ac and *cry* I Ac

(d) *cry* II Ab and *cry* I Ab

4. The main objective of production of pest-resistant GM crops is to **CBSE SQP 2024**

(a) encourage eco-friendly pesticides

(b) reduce pesticide accumulation in food chain

(c) eliminate pests from the field without the use of manual labour

(d) retain maximum nutritional content in the crop that would be otherwise consumed by pest

Ans. (b) reduce pesticide accumulation in food chain

Assertion-Reason Type Questions

Direction (Q. Nos. 5-9) *consist of two statements Assertion and Reason. Answer these questions selecting the appropriate option given below.*

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion

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

(c) Assertion is true, but Reason is false

(d) Assertion is false, but Reason is true

5. **Assertion** To generate only a part of the plant from a cell is totipotency.

Reason Suitable special nutrient media and sterile conditions are required '*in vitro*' conditions for the division of cells in explants. **CBSE 2025**

Ans. (d) Assertion is false, but Reason is true.

Assertion can be corrected as

Totipotency is the ability of a single cell to develop into a complete plant, not just a part.

6. **Assertion** Biotechnology produces transgenic microorganisms that function as microfactories for proteins.

Reason Transgenic microorganisms can be developed to produce proteins of human use, like insulin. **CBSE 2025, CBSE 2024C**

Ans. (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

7. **Assertion** Hepatitis-B vaccine is produced from yeast.

Reason All type of microorganisms help to prepare vaccine. **CBSE 2024C**

Ans. (c) Assertion is true, but Reason is false. Reason can be corrected as

Only specific or microorganisms, not all types, are used in vaccine production.

8. **Assertion** *Agrobacterium tumefaciens* is a pathogen of several monocot plants.

Reason It is able to deliver a piece of DNA known as T-DNA to transform normal plant cells into a tumor. **CBSE 2024 (Set-I)**

Ans. (d) Assertion is false, but Reason is true. Assertion can be corrected as

Agrobacterium tumefaciens is a pathogen of several dicot plants.

9. **Assertion** Functional ADA cDNA genes must be inserted in the lymphocytes at the early embryonic stage in gene therapy for ADA deficiency.

Reason Cells in the embryonic stage are immortal, differentiated and easy to manipulate. **CBSE 2024 (Set-I)**

Ans. (c) Assertion is true, but Reason is false. Reason can be corrected as

Cells in the embryonic stage are immortal, undifferentiated and easy to manipulate. Embryonic cells are pluripotent, i.e. they can give rise to all somatic cell types.

1. Which one of the following is not the product of transgenic experiments? **CBSE 2025**

(a) Pest-resistant crop variety

(b) High nutritional value is grains

(c) Drought resistant crops.

(d) Production of insulin by *r*DNA techniques.

Ans. (c) Drought resistant crops.
Drought resistant crops are usually developed through traditional breeding or genome edition, not by transgenic experiments.

2. 95% of the transgenic animals developed are

(a) cows (b) fish **CBSE 2024 C**

(c) rabbits (d) mice

Ans. (d) mice
Around 95% of transgenic animals developed are mice, as they commonly used for research in genetics and human diseases.

3. Which one of the following transgenic animals is being used to test the safety of the polio vaccine?

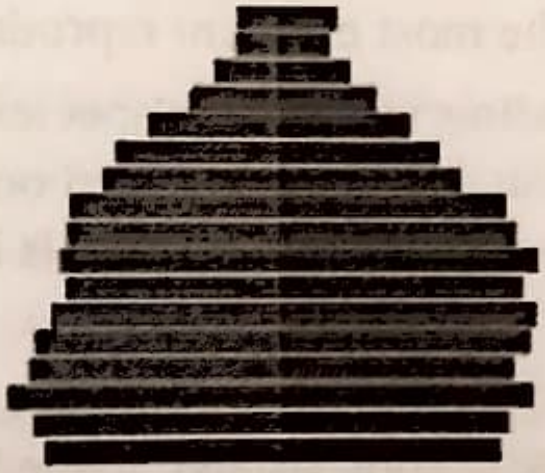
CBSE 2024 (Set-I)

(a) Sheep (b) Goat

(c) Pig (d) Mice

Ans. (d) Transgenic mice are being used to test the safety of the polio vaccine.

4. Given below is the age pyramid of population in one of the states in India as per 2011 census. It depicts the male population on the left hand side, female population on the right hand side, newborns towards the base and gradually increasing age groups as we move from base to the top, with the oldest population at the top. Study this pyramid and comment upon the appropriateness of the Assertion and the Reason.



Assertion It is a stable population.

Reason The pre-reproductive and reproductive individuals are almost in equal numbers and the post-reproductive individuals are relatively fewer.

CBSE SQP 2023

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

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

(c) Assertion is true, but Reason is false.

(d) Assertion is false, but Reason is true.

Ans. (a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.