CBSE NCERT Based Chapter wise Questions (2025-2026)

Class-XII

Subject: Biology

Chapter Name : Biotechnology: Principles and Processes (Chap : 9)

Total : 6 Marks (expected) [MCQ(2)-2 Marks, CBQ(1)-4 Marks]

Level - 2

MCQ

1. The function of ori in a cloning vector is to
   Ⓐ initiate transcription Ⓑ allow insertion of foreign DNA
   Ⓒ control copy number Ⓓ provide antibiotic resistance

Hint : Think of replication, not selection

2. Which enzyme is responsible for the formation of sticky ends?
   Ⓐ DNA ligase Ⓑ Exonuclease Ⓒ Restriction endonuclease Ⓓ DNA polymerase

Hint : Cuts DNA at specific sites

3. The selectable marker gene in pBR322 provides resistance to
   Ⓐ Ampicillin only Ⓑ Tetracycline only
   Ⓒ Both ampicillin and tetracycline Ⓓ Kanamycin and ampicillin

Hint : Two antibiotic resistance genes

4. Which step ensures maximum amplification of DNA in PCR?
   Ⓐ Denaturation Ⓑ Annealing Ⓒ Extension Ⓓ Cycling

Hint : Taq polymerase works here

5. Which vector is most suitable for cloning very large DNA fragments?
   Ⓐ Plasmid Ⓑ Phagemid Ⓒ BAC Ⓓ Cosmid

Hint : Used in Human Genome Project

6. Ethidium bromide is used to
   Ⓐ digest DNA Ⓑ stain DNA Ⓒ ligate DNA Ⓓ isolate DNA

Hint : UV fluorescence

7. The role of $CaCl_2$ in transformation is to
   Ⓐ activate ligase Ⓑ increase membrane permeability
   Ⓒ prevent degradation Ⓓ neutralize DNA

Hint : Heat shock follows

8. Which enzyme is thermostable?
   Ⓐ DNA ligase Ⓑ Taq polymerase Ⓒ Hind III Ⓓ EcoRI

Hint : Isolated from hot springs

9. Blue-white screening depends on
   Ⓐ antibiotic resistance Ⓑ lac operon Ⓒ origin of replication Ⓓ plasmid size

Hint : α-galactosidase

10. The correct sequence in recombinant DNA technology is
    Ⓐ Isolation → ligation → transformation → expression Ⓑ Ligation → isolation → expression → transformation
    Ⓒ Expression → isolation → ligation → transformation Ⓓ Transformation → isolation → ligation → expression

Hint : Logical lab order

Assertion and Reason :

Directions: Read the following questions and choose any one of the following four responses.

A: Assertion and Reason both are correct and Reason is the correct explanation of Assertion.

B: Assertion and Reason both are correct and Reason is not the correct explanation of Assertion.

C: Assertion is correct but Reason is wrong.

D: Assertion is wrong but Reason is correct.

1. **Assertion (A) :** Restriction enzymes cut DNA palindromically.
   Reason (R) : They recognize specific nucleotide sequences.
   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

2. **Assertion (A) :** PCR can amplify DNA exponentially.
   Reason (R) : Taq polymerase is destroyed at high temperature.
   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

Hint : Thermostability

3. **Assertion (A) :** Plasmids are ideal cloning vectors.
   Reason (R) : They replicate independently inside host cells.
   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

Hint : Extra-chromosomal DNA

4. **Assertion (A) :** Gel electrophoresis separates DNA fragments
   Reason (R) : DNA moves towards anode due to negative charge
   Ⓐ A Ⓑ B Ⓒ C Ⓓ D

Short Answer Questions :

1. Why is Taq polymerase preferred in PCR?

Hint : Temperature cycles

Key Points:

- Thermostable
- Survives denaturation
- No need to add repeatedly

2. Explain the role of selectable markers.

Hint : Screening recombinants

Key Points:

- Identify transformants
- Antibiotic resistance
- Eliminate non-recombinants

3. What are sticky ends? Mention their advantage.

Hint : Complementary overhangs

Key Points:

- Formed by staggered cuts
- Base pairing possible
- Efficient ligation

4. Why is *E. coli* commonly used as host?

Hint : Lab friendliness

Key Points:

- Fast growth
- Well-studied genetics
- Easy transformation

5. Mention any three properties of a good cloning vector.

Hint : NCERT list

Key Points:

- Origin of replication
- Selectable marker
- Unique restriction sites

LONG ANSWER QUESTIONS (5 MARKS)

1. Describe the steps involved in recombinant DNA technology.

Hint : Flow-chart

Points to include:

- Isolation of DNA
- Cutting with restriction enzymes
- Ligation
- Transformation
- Expression & downstream processing

2. Explain PCR with diagrammatic explanation.

Hint : Three steps

Points:

- Denaturation
- Annealing
- Extension
- Role of primers & Taq polymerase

3. Describe pBR322 as a cloning vector.

Hint : Labelled features

Points:

- ori
- amp^R & tet^R genes
- Restriction sites
- Importance in cloning

4. Explain gel electrophoresis and elution.

Hint : Separation principle

Points:

- Agarose gel
- Electric field
- Size-based separation
- UV detection & elution

5. What is downstream processing? Explain its significance.

Points:

- Separation
- Purification
- Quality control
- Industrial importance

Case Based Questions.

1. A student performs PCR but obtains very low DNA yield despite multiple cycles.

a) Identify the possible faulty step

b) Name the enzyme affected

c) Suggest one correction

d) Why does PCR show exponential amplification?

Hints:

- Temperature
- Taq polymerase
- Doubling each cycle

2. During transformation, bacteria fail to grow on antibiotic medium.

a) What does this indicate?

b) Which gene failed to express?

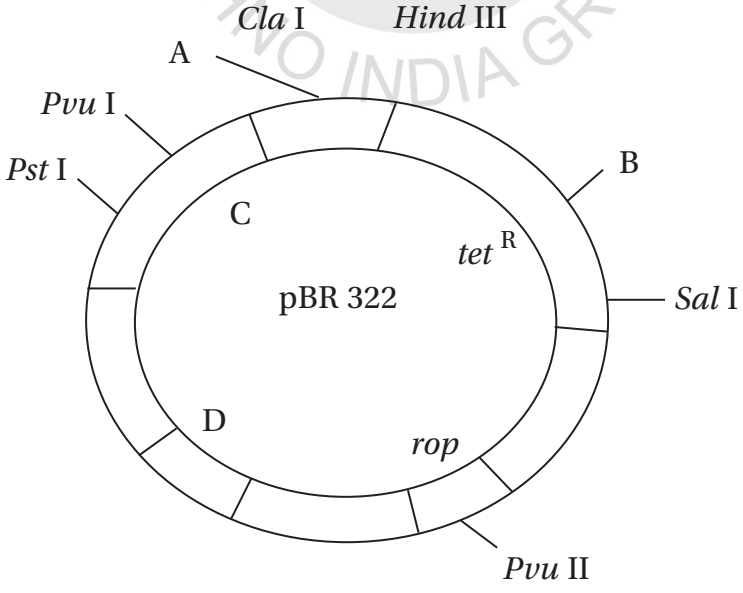
c) Name the process used to introduce DNA

d) Why are antibiotics essential?

Hints:

- Selection
- Marker gene
- Heat shock

3. Study the diagram of pBR322 plasmid and answer the following questions:



a) Identify the diagram
b) Name two selectable marker genes
c) Mark any two restriction enzyme sites
d) State one reason why pBR322 is widely used

Hints:

- amp^R & tet^R
- EcoRI / HindIII
- Cloning efficiency

ANSWER

MCQs

1. Ⓒ	3. Ⓒ	5. Ⓒ	7. Ⓑ	9. Ⓑ
2. Ⓒ	4. Ⓒ	6. Ⓑ	8. Ⓑ	10. Ⓐ

Assertion-Reason

1. Ⓐ	2. Ⓒ	3. Ⓐ	4. Ⓐ	5. Ⓒ