

Biotechnology: Principles and Processes — Assignment 2

Class 12 Biology · Higher-difficulty challenge set + integrated problems · Answer key included · Narayan Gurukul Academy

Instructions: (1) Attempt all questions; start with the topic-wise challenge set, then attempt the integrated (multi-topic) problems.
(2) Give all answers with correct SI units. $g = 10 \text{ m/s}^2$ unless stated.
(3) A final answer key is provided at the end — try the full set before checking it.

Part A — Topic-wise challenge questions

Principles of Biotechnology

1. Name the two core techniques of modern biotechnology.
2. What is genetic engineering?
3. Describe the principles of biotechnology.

Tools of Recombinant DNA Technology

1. Name the enzyme used to cut DNA.
2. What are restriction endonucleases?
3. Describe the tools of recombinant DNA technology.

Cloning Vectors and Competent Host Cells

1. What is a cloning vector?
2. How is a competent host cell prepared?
3. Describe the features of a good cloning vector.

The Process — From DNA Isolation to Transformation

1. What is transformation?
2. How is foreign DNA introduced into a host?
3. Describe the steps of recombinant DNA technology.

Selection of Recombinantants

1. What is a selectable marker?
2. How are recombinant cells selected?
3. Explain insertional inactivation.

Bioreactors and Downstream Processing

1. What is a bioreactor?
2. Why is downstream processing important?
3. Describe the components and working of a stirred-tank bioreactor.

Part B — Integrated problems (multi-topic)

1. Describe the process of recombinant DNA technology.
2. Describe the tools of recombinant DNA technology and their functions.
3. Explain transformation, selection and downstream processing.
4. Describe the features of a good cloning vector.
5. Describe the components and working of a stirred-tank bioreactor.
6. Explain the role of restriction enzymes and ligase in rDNA technology.

Answer Key

Principles of Biotechnology

Two core techniques: genetic engineering (altering genetic material) and maintaining a sterile environment for growing only the desired microbes.

Tools of Recombinant DNA Technology

Restriction enzymes (cut at palindromic sites), ligase (joins), polymerase (amplifies), vectors and host organisms.

Cloning Vectors and Competent Host Cells

A vector (e.g. pBR322) has ori, selectable marker and cloning sites; competent cells are made using CaCl₂ or electroporation.

The Process — From DNA Isolation to Transformation

Isolate DNA → cut with restriction enzymes → ligate into a vector → introduce into a competent host (transformation).

Selection of Recombinantants

Use selectable markers; insertional inactivation identifies cells where the foreign DNA has disrupted a marker gene.

Bioreactors and Downstream Processing

A stirred-tank bioreactor maintains aeration and mixing; downstream processing separates and purifies the product.

Integrated problems

1: Isolation → cutting → ligation → transformation → selection → downstream processing. 2: Restriction enzymes and ligase; vectors; hosts. 3: Transformation; marker-based selection; purification. 4: ori, selectable marker, cloning sites, small size. 5: Vessel with agitator, aerator and temperature/pH control. 6: Cut DNA at specific sites; join fragments into vectors.