

BIOLOGY • CLASS 12

9

CHAPTER

Biotechnology – Principles and Processes

NCERT SOLUTIONS



EXERCISE SOLUTION: QUESTION 1

1. List ten recombinant proteins used in medical practice and state their therapeutic uses.

Answer: Recombinant proteins are made using recombinant DNA technology. Five of the ten requested examples are shown here.

	Recombinant protein	Therapeutic use
1.	Human insulin	Helps control blood glucose in diabetes mellitus.
2.	Somatropin (human growth hormone)	Treats growth hormone deficiency.
3.	Epoetin alfa (erythropoietin)	Treats anaemia associated with chronic kidney disease.
4.	Coagulation factor VIII	Replaces missing factor VIII in haemophilia A.
5.	Coagulation factor IX	Replaces missing factor IX in haemophilia B.

EXERCISE SOLUTION: QUESTION 1 – CONTINUED

1. List ten recombinant proteins used in medical practice and state their therapeutic uses. (continued)

Answer:

The remaining five examples are:

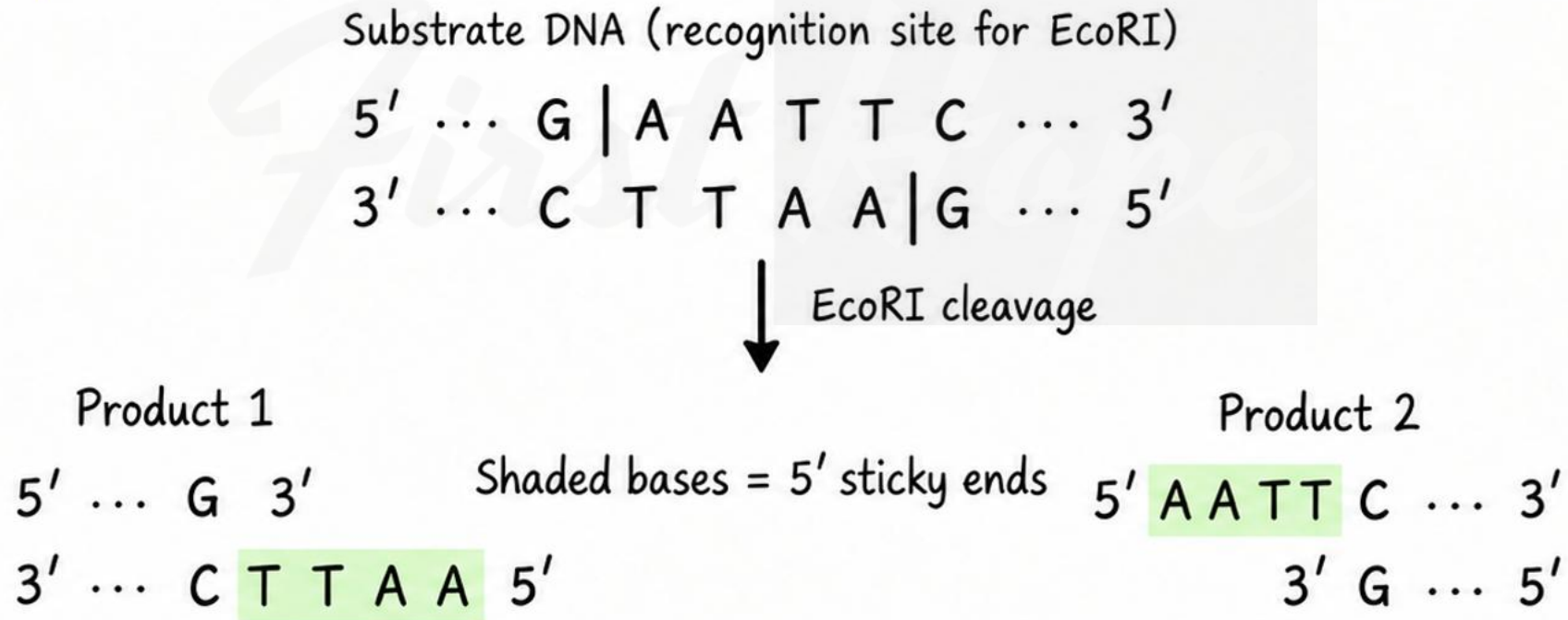
Recombinant protein	Therapeutic use
6. Filgrastim (G-CSF)	Increases neutrophils in selected conditions, such as chemotherapy-associated neutropenia.
7. Alteplase (tPA)	Dissolves blood clots in selected acute ischaemic strokes and other indicated conditions.
8. Interferon beta-1a	Used in relapsing forms of multiple sclerosis.
9. Dornase alfa (DNase I)	Thins mucus and improves lung function in cystic fibrosis.
10. Imiglucerase	Enzyme replacement for non-neurological manifestations of Gaucher disease.

EXERCISE SOLUTION: QUESTION 2

2. Make a diagrammatic chart showing a restriction enzyme, its substrate DNA, its cutting sites and its products.

Answer: EcoRI restriction endonuclease

EcoRI recognises a specific palindromic sequence in double-stranded DNA. It cuts the two strands at staggered positions.



The products have complementary 5' overhangs (sticky ends). Only the sugar-phosphate backbones are cut; the base sequence is not changed.

EXERCISE SOLUTIONS: QUESTIONS 3 & 4

3. Are enzymes or DNA molecules bigger?
How do you know?

Answer:

A typical chromosomal DNA molecule is much larger than an enzyme molecule.

Chromosomal DNA contains millions of nucleotide pairs, whereas most enzymes contain hundreds or a few thousand amino acids.

This is a general comparison: a short DNA fragment need not be larger than every enzyme.

4. What is the molar concentration of human DNA in a human cell?

Answer:

A numerical answer needs the cell volume and a definition of what is being counted.

Count intact nuclear DNA molecules in an unreplicated diploid cell (G_1): one per chromosome.

Number of DNA molecules = 46

$$n = \frac{46}{6.022 \times 10^{23}}$$

$$n = 7.64 \times 10^{-23} \text{ mol}$$

If cell volume = V litres:

$$C = \frac{n}{V} = \frac{7.64 \times 10^{-23}}{V} \text{ mol L}^{-1}$$

Mitochondrial DNA is excluded here. DNA mass per cell is not a molar concentration.



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